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64

RUDIMENTARY TREATISE
ON
MASTING, MAST-MAKING,
AND
RIGGING OF SHIPS.

By ROBERT KIPPING, N.A.

WITH ILLUSTRATIONS.

LONDON: JOHN WEALE. 1859.

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—37. Hawse pieces, cant hawse pieces, &c.

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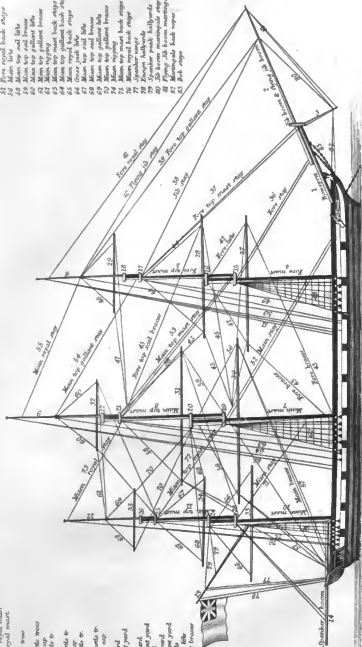
RUDIMENTARY TREATISE

ON

MASTING, MAST-MAKING, & RIGGING OF SHIPS.

- Masten gale beam
 4 Fore top gall & royal mast
 5 Main top gall & royal mast
 6 Mizzen top gall & royal mast
 7 Spunkier part
 8 Fore mast binnacle beam
 9 Fore mast cap
 10 Fore top m. binnacle beam
 11 Fore top mast cap
 12 Main mast binnacle beam
 13 Main mast cap
 14 Main top m. binnacle beam
 15 Main top mast cap
 16 Main mast binnacle beam
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 18 Main top m. binnacle beam
 19 Main top mast cap
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 21 Fore top sail yard
 22 Fore top gallant yard
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THE MASTS, YARDS, RIGGING, &c. OF A SHIP.

RUDIMENTARY TREATISE
ON
MASTING, MAST-MAKING,
AND
RIGGING OF SHIPS.

ALSO,
TABLES OF SPARS, RIGGING, BLOCKS; CHAIN, WIRE, AND
HEMP ROPES, &c. &c.
RELATIVE TO EVERY CLASS OF VESSELS.

TOGETHER WITH
AN APPENDIX OF DIMENSIONS OF MASTS AND YARDS OF THE
ROYAL NAVY OF GREAT BRITAIN AND IRELAND.

BY ROBERT KIPPING, N.A.,
Author of the Elements of Sailmaking, &c.

ILLUSTRATED WITH NUMEROUS WOODCUTS.

SIXTH EDITION.

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1861.

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PREFACE.

IN offering to the British public this rudimentary work, or outline of the Practice of Mastng, Mast-Making, and Rigging of Ships, the author has no apology to offer for its production. It was composed in the hours of relaxation from official duties, during the period of his employment in one of the largest private Naval and Commercial Dock Establishments in the north of England, where he had frequent occasion to direct his attention to the mode of making masts and spars of various forms and dimensions, and witnessing other extensive works of rigging and equipment of ships. In addition to this, he devoted his evening hours to the perusal of the latest eminent publications on these subjects, and procured information from every possible source, with a view of rendering this work useful for elementary and practical purposes; he has, it is presumed, collected some valuable materials, and cast the result into one mould. A book of larger proportions and of greater price might have been drawn up with far less intellectual labour; this, however, would not have tended to accomplish the purpose which the publisher had in view, in issuing this Rudimentary Series, namely, to accord with the often limited resources of students. By adopting a small type and a full page, and joining together an

immense quantity of tabular matter, the author has been enabled to attempt more, within the same number of pages, than has previously been effected in other works on the same subject.

The result of this undertaking is humbly submitted, trusting that it will meet with indulgence for any faults that may be contained therein; as, with the needful application to his profession, the author has no leisure to cultivate a literary style.

Since this work was written, Mr. Weale requested the insertion in these pages of Dimensions of Masts and Yards of some of H.M. ships, which were not originally intended. The author not wishing to disturb the work after it was arranged for the press, and yet being anxious to co-operate with the publisher to meet the suggestion and wishes of numerous applicants, it was proposed between them to add an Appendix to this work, which it is hoped will give satisfaction to the public.

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RUDIMENTARY TREATISE

ON

MASTING AND RIGGING OF SHIPS.

CHAPTER I.

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General description of Masts.—Equipping a Ship with Three Masts and a Bowsprit.—The Timbers used for Masts.—Selecting Firs.

MASTS are long pieces of timber, rounded a great part of their length and erected on the keel of a ship, upon which are attached the yards, the sails, and the rigging, in order to their receiving the wind necessary for navigation. The lower masts of the largest ships are composed of several pieces of the soundest part of trees united into one body. As these are generally the most substantial parts of various trees, a mast formed by this assemblage is justly esteemed much stronger than one consisting of any single trunk, whose internal solidity may be very uncertain.

The principal things to be considered in equipping a ship with masts are, *first*, the number; *second*, their situation in the vessel; and *third*, their height above the water. The masts being used to extend the sails by means of their yards, it is evident that if their number were multiplied beyond what is necessary, the yards must be extremely short, that they may not entangle each other in working the ship, and by consequence their sails will be very narrow, and receive a small portion of wind. If, on the contrary, there is not a sufficient number of masts in the vessel, the yards will be too large and heavy, and cannot be managed without difficulty. There is a mean between these extremes which experience and the general practice of the sea have determined, by which it appears that in large ships every advantage of sailing is retained by three masts and a bowsprit.

The exact height of the masts in proportion to the form and size of the ship remains yet a problem to be determined. The more the masts are elevated above the centre of gravity the greater will be the surface of the sail which they are enabled to present to the wind,—so far an additional height seems to be advantageous. But this advantage is diminished by the vibrating movement of the mast, which operates to make the vessel stoop to its effort; and this inclination is increased in proportion to the additional height of the masts—an inconvenience which it is necessary to guard against: thus what is gained upon one hand is lost upon the other. To reconcile these differences, it is certain that the height of the mast ought to be determined by the inclination of the vessel, and that the point of her greatest inclination should be the term of the height above the centre of gravity. With regard to the general practice of determining the height of the masts, the extreme *breadth* of the ship from out to out has been admitted by long use the best rule for determining the length of the masts, that they may have proper support by the spread of the rigging.

The timbers commonly used for masts are fir and pine, and are distinguished by mast-makers by the name of the place from which they are exported—as, the Norway and Riga firs, Canada red, yellow, and white pines, &c.

The lower masts are generally made of yellow and the topmasts of red pine. In the selection of trees for making masts, yards, &c., it is of very great importance, not only on account of waste and expense, but because the safety of a ship in tempestuous weather frequently depends on its quality.

Before commencing to make a mast, yard, &c., or any part thereof, the tree designed for the purpose should be examined whether it be sound and fit, by cutting a short piece off the butt or thickest end, to see the heart. Should it have pale-red tints and white spots intermixed, and is rotten or shaky at the heart, the timber must have more pieces cut off while there remains sufficient length. When approved of the butt, examine along the sides, by taking chips off with the adze at different places and clear away the sap, and minutely examine every knot, rind-gall,* &c. If it possesses the necessary qualities of soundness line and measure it to the diameter and length required.

* Rind-gall is the damage which a tree receives when young, so that the bark or rind grows in the inner substance of the tree.

CHAPTER II.

Masting of Ships.—Placing of the Masts in relation to Water-line.—
The Proportions for the Rake.—Stive of the Bowsprit.

THE masting of ships, or the placing of the masts, belongs to the business of the builder or constructor of the ship; and the form given to the vessel varies the disposition of the masts, for it is evident that a full-bowed ship requires her foremast to be placed further forward than a sharp one; consequently, though a general rule may be given, still every builder should consider the nature of the form of his vessel, and vary the disposition of her masts accordingly. The following tables of rules, taken from Mr. Fincham's work, will assist the builder in the placing of masts.*

LUGGER RIG.

Species of Masts.	Length. Breadth.		Known quantities.	Proportions in terms of known quantities.	
	Example 1	Example 2		Ex. 1. Common.	Ex. 2. Lugger.
	55-0 ft.	77-0 ft.			
	16-75 ft.	22-7 ft.			
Fore-mast before the middle	Length on water-line x			Before. 4	Before. 396
Main-mast from the middle.	Do. do. x			Abaft. 037	Abaft. 04
Mizen-mast or driver abaft.	Do. do. x			Abaft. 444	Abaft. 396
Main-mast to rake	In 12 feet . . x			16 in.	12 in.
Fore-mast to rake	Do. . . x			10 in.	6 in.
Mizen-mast to rake	Do. . . x			20 in.	24 in.
Bowsprit to stive.	Do. . . x			6 in.	6 in.

* The load-water line is to be considered the principal line of bearing of the ship, from which the stations of the masts are to be determined.

LATEEN RIG.

Example .	Length. 125·0 ft.	Breadth. 32·0 ft.	Known Quantities.				Proportions.
Species of Masts.							
Main-mast from the middle			Length on water-line	.	x		·300
Fore-mast before the middle			Do.	do.	.	x	Before. ·407
Mizen-mast abaft	.	.	Do.	do.	.	x	Abaft. ·407
Main-mast to rake	.	.	In 12 feet	.	.	x	·000
Fore-mast to rake	.	.	Do.	.	.	x	Forward. ·23 in.
Mizen-mast to rake	.	.	Do.	.	.	.	Aft. ·12 in.

YACHTS, CUTTER RIG.

Yachts {	Length.	Breadth.	Known Quantities.	Proportions in terms of known quantities.	
	Ex. 1. 63·1 ft.	19·2 ft.		Cutter. Ex. 1.	Cutter. Ex. 2.
Species of Mast.					
Mast before the middle on the water-line . . .			{ Length of water-line taken from the fore part of the stem to after part of post . }	·112	·14
Mast to rake from the water-line . . . }			In 12 feet . . .	12 in.	15 in.
Bowsprit to stive from the water-line . . . }			In 12 feet . . .	7½ in.	10½ in.
Bowsprit to house from the fore part of the stem }			Breadth . . .	·62	·53

SCHOONERS, THREE MASTS, BRIG FORWARD, COMMON, AND BERMUDA RIG.

Schooner, three masts . Do. brig for. Ex. 1 . Do. do. Ex. 2 . Do. common . Do. Bermuda, Ex. 1 . Do. do. Ex. 2 .		Length. Breadth. 78.7 ft. 21.6 ft. 110.6 ft. 23.6 ft. 102.5 ft. 25.8 ft. 90.0 ft. 24.0 ft. 93.0 ft. 24.7 ft. 94.7 ft. 24.0 ft.		Known quantities.		Proportions in terms of known quantities.					
						Schooners.		Common.		Schooners.	
						Three Masts.	Brig forward.	Ex. 1.	Ex. 2.	Ex. 1.	Ex. 2.
Main-mast from the middle .	.	.	Length of water-line .	.	.	Abaft. -033	Abaft. -11	-107	-046	-103	-084
Fore-mast before do. .	.	.	Do. . . . .	.	.	-295	-3	-294	-333	-279	-31
Mizen-mast abaft do. .	.	.	Do. . . . .	.	.	-366	—	—	—	—	—
Main-mast to rake .	.	.	In 12 feet . . . . .	.	.	27 in.	33 in.	28 in.	24 in.	24 in.	33 in.
Fore-mast to do. .	.	.	Do. . . . .	.	.	24 in.	28 in.	18 in.	15 in.	16 in.	36 in.
Mizen-mast to do. .	.	.	Do. . . . .	.	.	30 in.	—	—	—	—	—
Bowsprit to stive .	.	.	Do. . . . .	.	.	22 in.	36 in.	33 in.	34 in.	24 in.	22 in.

BRIGS.

Species of Masts, &c.	Known quantities.	Proportions in terms of known quantities.		
		Brigs of War.		Yachts as Brigs.
		Ex. 1.	Ex. 2.	
Main-mast abaft the middle	{ Length on the water-line . } x	·147	·138	·144
Fore-mast before the middle	Ditto x	·331	·323	·323
Main-mast to rake . .	In 12 feet . x	10 in.	9 in.	10 in.
Fore-mast to rake . .	In 12 feet . x	3 in.	2 in.	2½ in.
Bowsprit to stive . .	In 12 feet . x	51 in.	48 in.	52 in.

CORVETTES.*

Species of Masts.	Known quantities.	Proportions in terms of known quantities.	
		Ex. 1.	Ex. 2.
Fore-mast before the middle	{ Length of water-line } x	·372	·399
Main-mast abaft "	Do. x	·079	·06
Mizen-mast abaft "	Do. x	·375	·356
Rake of fore-mast . .	In 12 feet . .	2 in.	1½ in.
" main-mast . .	In 12 feet . .	6 in.	10½ in.
" mizen-mast . .	In 12 feet . .	10 in.	10½ in.
Stive of bowsprit . .	In 12 feet . .	64 in.	50 in.

* Corvettes embrace the tonnage of large merchant ships.

FRIGATES.

Species of Masts.	Known quantities.	Proportions in terms of known quantities.			
		Ex. 1.	Ex. 2.	Ex. 3.	Ex. 4.
Fore-mast before the middle	{ Length of } water-line } ×	·37	·364	·374	·39
Main-mast abaft do. .	Do. ×	·062	·073	·059	·068
Mizen-mast abaft do.	Do. ×	·341	·35	·335	·404
Rake of fore-mast .	In 12 feet ×	2 in.	1½ in.	1½ in.	1 in.
" main-mast .	In 12 feet ×	6 in.	5½ in.	5 in.	5 in.
" mizen-mast .	In 12 feet ×	10 in.	11 in.	9 in.	9 in.
Stive of bowsprit .	In 12 feet ×	63 in.	54 in.	60 in.	60 in.

The preceding tables of the positions of the masts under different rigs are given, that constructors may form a comparison with other ships in their calculation of the centre of effort of the sails, and to bring the point of sail and the fore and after moments* within the limits, and according to rules laid down, and alter them as the results may require.

When a sharp-bowed vessel or ship has her mast to rake, it frequently eases her in pitching, but never adds to her sailing, the wind having less power on her sails; it is, however, necessary that a ship's main and mizen-masts should rake more than the fore-mast; for, by separating them in this way, the wind acts with more power on all the sails, when close-hauled, which otherwise would not be effected, and be of little or no advantage to the ship.

Before the positions of the masts are fixed, it is necessary to make a plan of the sails, and find the centre of effort, and compare it with data that have been furnished from ships that were found to work well. An example of the method of finding the centres of gravity of sails, and determining the position of the centre of effort of the moving force or the sails of a ship, is given, page 74, Part I., "Rudimentary Naval Architecture."

* The relation which the fore and after moments should bear to each other is 1 : 72 to 1 : 77. See "Elements of Sailmaking," by R. Kipping.

CHAPTER III.

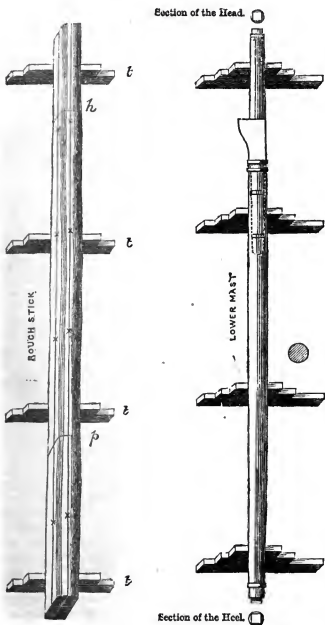


Mast-making.—Built Masts.—Single-tree Masts, Converting and Lining.—The Hounds Pieces.—Mast-head with Oak Checks.—The Fittings of the Mast-head and Puttock Shrouds.—The Fittings for Mast-heads of Steam-vessels.—Brigantine's Mast-heads.—The Framings of the Mast-heads of Steam-vessels.—Framing of Brigantine's Main-mast.

THE size of trees required for the making the lower masts of the largest ships in the navy, both as to diameter and length, but especially the latter, is so great that it is impossible to procure timber of natural growth fit for the purpose. They are therefore composed of several pieces united into one body. As before observed, these being generally the most substantial parts of various tiers, a mast formed by this assemblage is justly esteemed much stronger than one consisting of any single trunk, whose internal solidity may be questionable. And the mode of securing these built masts, as they are termed, by means of several strong hoops of iron driven on the outside of the mast, seems to fulfil the old adage of "a bundle of sticks that could not be broken when so united." It will not be attempted in this rudimentary volume to describe how the several parts of a made mast are put together, as it would require a very large plate to accompany the explanation, and, besides would be of little use to the *mercantile marine*. The method of making *single-tree masts* is as follows:—

ON SINGLE TREE MASTS.

The stick, when appropriated, butted, and its soundness examined, is laid upon the blocks or thawts, *t t t*, pieces of plank piled upon one another, upon which it is to be trimmed; when not quite straight, its hollow side is made the after-side; it is, however, usual to line the bent side first, and a straight middle line is struck along it; then the heights of the decks set up thereon from the butt, which is called the housing, and determines the place for the partners, *p*, where the mast has the greatest diameter. From the heel, set up



the whole length of the mast, and from the place for the partners the mast is divided into four parts each way, termed off-sets or quarters; that nearest the partners, the first; the next, the second; the other, the third. The different proportions of the given diameter are set off at those places: at the first, second, third quarters, heel, partners, hound, and head; the mast is formed to these the fore-and-aft way; but athwartship it is made straight from the third upper quarter to the head, instead of preserving the proportion given at the hounds, &c. All masts are first made square by being hewed perpendicular to the lines of the upper surface; the sides are hewed in at different places until the plumb-line is perpendicular to the line struck on the surface. The rough wood between these places chopped is hewed off out of winding with the spots plumbed down.

When the mast is sided, it is canted or turned with the trimmed side up, and a straight middle line is struck along perpendicular to a vertical line upon each end; then the quarters and other divisions are squared up from the first middle line struck, and the diameters set off as before from the second middle line. The sides are then hewed square to the surface from those lines as done the first.

The parts that are to be rounded are eight-squared, thus— $\frac{1}{4}$ of the diameters are set off on each side of the middle line, on every side, or $\frac{1}{4}$ set in within the edges, and lines struck with fair curves: then the angles or edges are taken off straight to the lines on each side, and made cylindrical. At the stops $\frac{1}{8}$ of the given length, or two-thirds of the mast-head are left square for the hound-pieces, and above once and a half the depth of the trestle-trees for the trestle-trees, &c.; but when the mast has long hound-pieces, it is left square three-fourths of the length of the mast-head, above the lower part of the lower hoop has its angles rounded off in an easy manner; for by making it cylindrical, a proper seating for the cap would not be obtained. The angles are first taken off to one-seventh of the size of the mast-head each way; and then the other angles formed are taken off to one-fourth of the size of the squares, till they are reduced sufficiently small to form a fair curve with a plane; and below the square it is formed into the round, or what is called *hanced into it*, with a hance about five-sixths of the length of the hounds, below which it is made round—but sometimes a small chamfer only is taken off the masthead.

THE HOUND-PIECES.

The annexed diagram exhibits the fittings of the main-mast to brigantines, and the hound-pieces and knees in one piece:—

a a, cross-trees.

b, short cross-tree.

c, the lower-cap with an iron band.

d, bolster.

e, iron plate with an eye bolt.

f, for boom topping lift.

g, eyebolt for the forebrace.

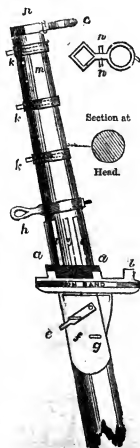
h, hoop and large eye for throat hallyards (this bolt is commonly fastened with a nut and screw at the fore part).

i i i, masthead battens.

k k k, eyebolts through the hoops for peak-hallyards.

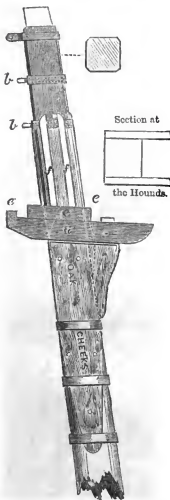
m, sheave in masthead for top rope.

The hound-pieces in single-tree masts are formed with the knees in one piece,—they are in thickness half that of the trestle-trees, and never less than three inches thick; in breadth they are the same as the masthead, with an extra breadth for the breadth of the knee which is formed on the fore part for supporting the trestle-trees, the breadth of the knee being equal to the diameter of the topmast, or it may extend to the fore side of the fid-hole; and their length is two-fifths of the length of the head, without the additional length, or one-eighteenth the given length of the mast.



MAST-HEAD WITH OAK CHEEKS.

To this mast-head is shown the fittings, as is common to brigantines' foremast. In the adjoining figure—



a, the hoop and roller for horizontal stay.

b b, eyebolts through the hoops, clenched on the fore side for peak-hallyards.

c, bolster.

d, trestle-trees.

e e, cross-trees.

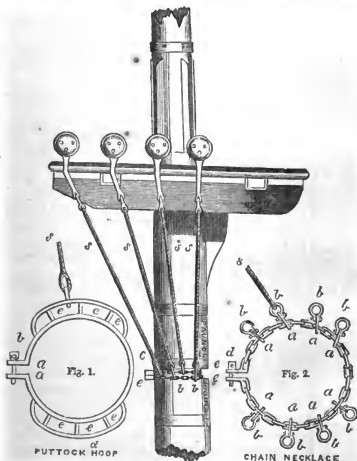
f f, battens on the mast-head.

The hound-pieces are coaked to the mast either by two square coaks formed out of the mast, or by circular coaks; and are bolted with five through bolts, driven through from alternate sides, and clenched upon the opposite. They are placed, the two upper and the two lower bolts, about one-fifth the diameter of the masthead from the fore and after sides; the two upper bolts about nine inches from the stops, and the two lower one-third the length of the hounds from the lower end; the other bolt is placed in the middle line of the mast, and at equal distances from the upper and lower bolts. A strengthening bolt is driven fore and aft through the knee and hounds-piece, just above the two upper bolts. The lower end is nailed with about

six nails, two inches from, and following the curve of the end; a hoop is, however, to be preferred on the lower end of the hounds-piece, as the nails injure the mast.

THE FITTINGS OF THE MAST-HEAD AND PUTTOCK-SHROUDS.

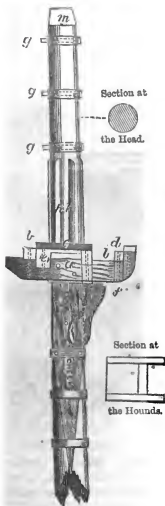
The fittings which are commonly fixed for mast-heads, are shown in the figs. 1 and 2. In the royal dockyards, a chain necklace is preferred to a hoop, as it brings less strain on the mast; this chain has shackles, *a b*, fitted into the links to which the puttock-shrouds are attached, *s s s s*.



It is brought tight on the mast by a screw, *d*, passing through the ears, *e e*. But in the merchant service, a hoop is fitted, and the puttock-shrouds are attached, as *c d*, fig. 1, and kept separate by the bars, *e e e*, which also supports the hoop. It is similarly brought tight on the mast, as the chain necklace, by having two ears, *a a*, and the screw *b*.

THE FITTINGS FOR THE FORE-MAST-HEADS OF STEAM VESSELS.

In the annexed sketch the fittings which form the cross-trees are shown thus :—



- a*, the trestle-trees.
- b b*, the cross-trees.
- c*, bolster.
- d*, connecting piece.
- e*, block fitted on the after side of the mast, in which are two sheaves for throat-hallyards.
- f*, eyebolt for slinging the foreyard.
- g g g*, eyebolts for peak-hallyards.
- h h*, battens on the mast-head.

THE FITTINGS FOR THE MAIN-MAST-HEAD OF STEAM VESSELS.

In the annexed figure are shown the several fittings, as,—

a, trestle-trees.

b b, the cross-trees.

c, the bolster, which reaches from the fore-side of the mast to the chock, *g*, between the trestle-trees.

d, block with two sheaves, as shown in *e*, foremast, for throat-hallyards.

e, plate and eye for the boom-topping-lift with two bolts.

f, eye-bolt for the topsail brace.

h, eye-bolt for the fore-brace.

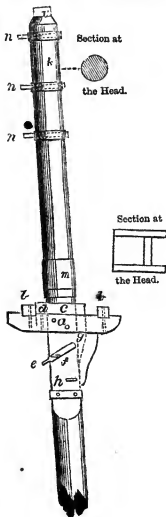
i, tenon for iron cap.

k, sheave in mast head for the top rope.

n.n n, eye-bolts for the peak-hallyards.

m, iron plate round the mast for the chain rigging.

The head of this mast is round, as per the section, and the hounds are made square; the knee and hounds-pieces are in one piece, and secured with three bolts, also a hoop is put on at the lower part with two bolts drove through it.

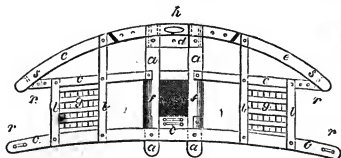


BRIGANTINE'S FORE-MAST AND MAIN-MAST.

The fore and main masts, as shown in pages 11 and 12, have eye-bolts, *k k k*, for the peak-hallyard, and the main mast has an eye and outrigger for the throat-hallyards, with a plate for the boom-topping-lift, *e*. The outrigger is bolted through the mast, and secured with nut and screw at the point.

THE FRAMING OF THE MAST-HEADS OF STEAM-VESSELS.
FORE-MAST.

The fore-mast has two cross trees, *c c c*; their lengths are, for the foremost one, *one-third* the hounded length of the topmast, and the after one *two feet* longer than the foremost one. They are curved aft, nearly equal to the diameter of

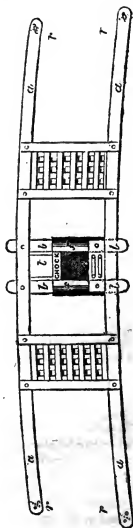


the topmast. The framing is formed by the trestle-trees, *a a*, and cross-trees, and have, in connection with these, the curved cross-tree, *c c*, which is joined on the fore end of the trestle-trees, and forming a sweep to the outer end of the foremost cross-tree, its after side having a connecting piece, *d*, bolted on, and an iron strap, *s*, over each end. The gratings, *g*, between the cross-trees are fixed and strengthened by two iron plates, *b b*, for standing upon. Rollers, *r r*, are fixed in the ends of the cross-trees, for the topmast rigging, and a block between the mast and after cross-tree, for the throat-hallyards; between the fore cross-tree and connecting piece a hole, *h*, is made for the slings of the yard, and the bolster, *f*, is brought on the trestle-tree for the lower rigging to lie over.

THE FRAMING OF THE MAST-
HEAD OF MAIN-MAST OF
STEAMER.

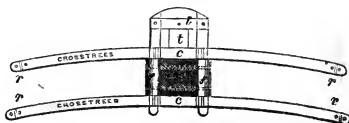
Two cross-trees, *a a*, and two trestle-trees, *b b*, combined together is the framing of the main-mast. The cross-trees are in length that the foremost one may carry the top-mast shroud *two feet* without a straight line from the stops to the outer part of the gunwale, and the after one is longer than the foremost one by two feet. Sufficient space is to be allowed between the cross-trees for the block, *c*, for the throat-hallyards, diameter of the topmast, *t*, and one inch for the heeling. The breadth of the trestle-trees extends the same before the foremost cross-tree as abaft the after one. Rollers, *r r*, are fixed in the ends of the cross-trees for the topmast rigging, and bolsters, *f f*, are brought on the trestle-trees for the lower rigging.

Small steamers have but one iron cross-tree.



THE FRAMING OF THE MAST-HEAD OF BRIGANTINE'S MAIN-MAST.

The framing consists of two long cross-trees, *c c*, and a cross-tree, *b*; the long cross-trees are separate the thickness of the mast-head at the stops, and the short cross-tree is beyond the foremost cross-tree, the diameter of the heel of the topmast, *t*, and one inch for the heeling. The length of the



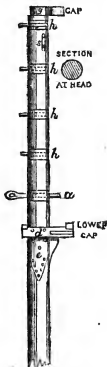
two long cross-trees, the same, must be observed as for the mainmasts of steamers. A chock is placed between the trestle-trees at the fore part of the short cross-tree, to receive an iron band, *c*, page 11, which passes round to the after part of the trestle-trees. Rollers, *r r*, are fixed in the ends of the cross-trees for the topmast rigging, and likewise there are bolsters, *f f*, for the lower rigging.

THE FITTINGS OF SCHOONERS' AND CUTTERS' MASTS.

The given lengths of schooners' and cutters' masts are generally the heading and hounding, and of similar form as single-tree masts without cheeks, but differing in having their heads rounded, and the diameter at the hounds or stops about a quarter less than the given diameter; a stop is formed about one inch on the foreside at the hounds, for the support of the lower cap, *d*.

On the masthead is placed five hoops; the lower hoop, *a*, is made with a wide collar to receive the shoulder of an iron outrigger, with an eye formed for the throat-hallyards; this hoop is put on from 2 feet to 2 feet 6 inches above the underside of the lower cap. The upper hoop is placed 6 inches below the upper cap, and three others are spaced

at equal distances between the upper and lower hoops. These hoops, *h h h*, have all eyebolts drove through them from the afterside of the mast, and clenched on the foreside for the peak-hallyards; their eyes lie horizontally; they are placed on the head for the upper and lower ones to be in the middle line on the afterside of the mast, and the two



between these 1½ inch on each side of the middle line. A hoop is also driven on the heel of the mast, about 6 inches above the shoulder of the tenon. There is a sheeve, *s*, in the masthead for the top rope; *g*, is the iron cap; *d*, the lower cap; *e*, the hounds-piece. The afterside of the mast is coppered in the wear of the gaff and boom.

CHAPTER IV.

Bowsprits of Single Trees and Caps.—On the Jibboom.—Saddle for the Jibboom.—On the Flying Jibboom.—The jibboom and Flying Jibboom in one.—Top-masts.—Top-gallant and Royal-masts in one.—Stump-pole top-gallant-masts.—Caps on the Lower Masts.—Top-mast Cap.

THE given length of a bowsprit is from the fore part of the tenon of the cap to the after part of the tenon at the heel. The part which rests upon the stem and apron is called the *bed*; the inner part, from the outer end of the bed to the heel, the *housing*; and nearly at the outer end is the head, or *bees' seating*. The general proportion of the outer end to the given diameter is *two-thirds*, and the inner end *five-sixths* of the given diameter. The ends are tapered from the bed each way, and rounded their whole length, excepting the bed, and on the upper part from the bed to the outer end is left square, for the men to walk out upon. Cleats used to be nailed on the bowsprit for the collars of the stays and bobstays; instead of these, wood is now left on to form the stops, *a a a*, as here shown.



There has been lately introduced another method of making these stops, which are, two iron straps or splints, *b b*, with stops, *s s s*, formed on them; they are let in flush on the under-side, and extend from the forestay-hoop to the outside of the cap, and therefore adds materially to the fastening of the cap, and preventing the under part of it from working loose. These straps are two inches wide and a quarter of an inch thick in the largest size single-tree bowsprit; the stops on them are about the thickness of the hoops

for the bobstays, and the ends of them screw-bolted, to pass through the lower part of the cap to screw it up firmly to

the end of the bowsprit. A few nails fasten the straps until the hoops are put on to their places.

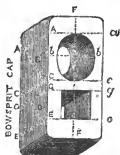
• *To hoop a single-tree bowsprit.*—One hoop is driven on the heel, and one 4 inches within the aftside of the cap.

The *bees* are fixed on the head, as shown by *g*, and have sheeve holes for the foretopmast-stay.

The *heel*.—The lower part of the heel is on a level with the deck, and the upper part in the direction of the bowsprit.

The *bowsprit cap*.—The length of the cap is in general five times the diameter of the jibboom, and the breadth twice the diameter, and the thickness one inch less than the diameter of the jibboom. The cap is of a parallel thickness, and the athwartship sides are cut square and parallel to the breadth. The ends are square athwart and fore-and-aft to the angle made by the stive of the bowsprit.

Below the upper end, in the direction of the stive, its thickness is set down on both sides, and a line, *AA*, drawn through parallel to the upper part of the cap, which is the station for the upper part of the hole for the jibboom. Set down square to the line *AA*, the diameter of the jibboom *B*, and three quarters of an inch play; draw the line *cc*, parallel to *AA*; this will give the station for the lower part of the hole. Draw *Aa* and *cc* square across athwartship of the cap. As the hole will be an oval shape, both sides athwartships, on account of the stive, the distance *Ac* will therefore be the long diameter, and the perpendicular *B*, equal to *bb*, the short diameter; to these diameters an ellipse or oval must be described for the hole that the jibboom slides through. Observe, in setting off the hole, that three quarters of an inch is to be added to the size for leathering. From the under part of this hole, set down two-sevenths the diameter of the bowsprit square across, as *Gg*, for the upper part of the hole, and draw a line, *Gg*, parallel to *cc*; then five-sixths the diameter of the outer end of the bowsprit is set down the middle line *FF*; and *Ee* and *Ee* are respectively drawn parallel to *Gg* and *Gg*; these lines will give the lower part of the square hole on the fore and after parts of the cap.



The cap, when trimmed and prepared for the tenon on the outer end of the bowsprit, is next iron-bound and eye-bolts driven through and clenched, for the man-ropes, foot-ropes, &c.

ON THE JIBBOOM.

The jibboom has a straight line struck across the middle : the butt end of the tree is worked inwards, and the length set up. The given diameter is at the bowsprit cap, or at one-third the length from the inner end, from which it is made parallel. From the cap to the outer end is divided into four quarters, and the outer end is made two-thirds the given diameter. It is lined to the size, and hewed plumb ; afterwards squared and eight squared, and three and a half diameters is left eight-squares from each end, and between the ends it is rounded. A stop is made at the outer end once and one-sixth the diameter in length ; and a sheave hole one diameter and one-sixth in length within the stop from the upper side, for the outhauler or the jibstay to pass through ; and at the heel is a horizontal hole for the lashing down of the heel ; a horizontal sheave once and one-sixth the diameter in length, for the top-rope. An iron for the flying-jibboom is placed upon the starboard eight-square at the outer end.

SADDLE FOR THE JIBBOOM.

The saddle is fayed upon the bowsprit, at one-third the length of the jibboom within the outer end. It is in length one-half the diameter of the bowsprit ; in width, one-half the diameter of the jibboom ; and, in thickness, one-sixth the given diameter. A seat is made upon the upper part for the heel, so that the jibboom may lie parallel with the middle line of the bowsprit, and it is fastened to the bowsprit after the bowsprit and the jibboom are rigged, with one rag-pointed bolt in the centre and a nail in each end.



ON THE FLYING JIBBOOM.

The heel of the flying-jibboom generally steps against the cap ; the usual proportion is two-thirds the jibboom and two-thirds the given length of the flying-jibboom. The

given diameter is at the iron on the end of the jibboom, and the outer end is two-thirds, and the inner end three quarters of the given diameter. From the place of the given diameter it is made parallel to two-thirds the length from the inner end; the distances from these to the ends are rounded. A stop is made to one diameter in length within the outer end, and a vertical sheave is cut within the necking, for the flying-jibstay; and at the inner end a horizontal hole is bored.

THE JIBBOOM AND FLYING-JIBBOOM IN ONE.

Here the length to the stops will be the length of the jibboom; and from the stops to the outer end will be two-thirds the given length of the flying-jibboom. The diameter at the stop for the jibboom is two-thirds, and at the extreme end one-third of the given diameter. It has sheaves cut for the jib and flying-jibstays as the preceding jibbooms.

TOP-MASTS.

The length of topmasts is given the same as the standing masts, viz., the hounded and headed lengths; or the whole length including the length of the head. They require to be such thickness as to permit the hounds to pass through the cap. The given diameter is at the lower cap, from which place it is made parallel to the heel; and, at the stops and head, the diameters are four-fifths and five-ninths respectively of the given diameter. It is lined to these sizes, and *hewed* from the lower cap sixteen-square, and rounded to the under part of the hounds, which are nearly eight-squared, to admit them through the round hole in the lower cap. The fore and after stops, *c*, are formed as per the figure annexed; the head is left square above the stops, and the edges chamfered between the upper side of the cross-trees and the under side of the cap. The heeling is to be square, and the edges chamfered; and, if not sufficient to fill the hole in the trestle-trees, fillings are fayed and nailed thereto to supply such deficiency, allowing a quarter of an inch play. The *heeling* is in length two to two and a-half diameter, and brought into the size of the eight-square. In the middle of the heeling a square hole, *f*, is cut through athwartships for the *fid*; its lower part to be

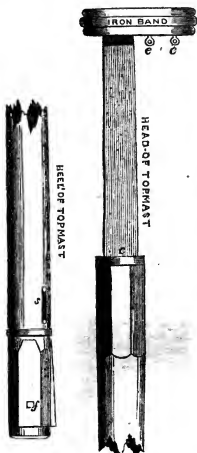
the depth of the trestle-trees above the upper part of the hoop, and one inch for an iron plate that is brought on the trestle-trees. *Iron fids* are mostly used, and are in length once and a-half the given diameter of their lower masts; in depth one-third the given diameter of their top-mast, and in thickness two-thirds their depth.

Fids are made square to the given dimensions, and one end rounded, the other snapped from the under side, and a hole for a laniard in both ends.

The sheave-hole for the top-rope.—There is one sheave, *s*, at the heeling above the fid-hole, which is cut through transversely in the middle of the eight-square of the larboard side to the foremost eight-square on the starboard side. A groove is taken out, rather larger than the top rope, when passing through the square hole in the trestle-trees, and is in the direction of the sheave-hole.

The sheave-hole for the topsail-tye.—Most of the ships in the merchant-service have a sheave-hole cut through the middle of the hounds fore and aft; but, as it weakens the

mast, it is preferable to have *blocks* in lieu of a sheave-hole.



TOP-GALLANT AND ROYAL-MASTS IN ONE.

It is now common to have the top-gallant and royal masts in one, *T, r*. The given length is set off from the lower end; and, from the heel to the length of the top-gallant mast is set off; then, from the top-gallant stops, the length of the royal mast is measured, and a very short pole above the royal stops, *t*, is allowed.

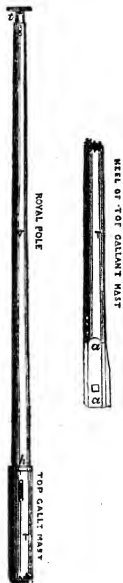
The given diameter, which is at the station of the cap, is set off from the lower end; and at the top-gallant stops, *h*, it is $\frac{1}{2}$ of the given diameter, and at the royal stops three-fifths of the given diameter. It is quartered and graduated the whole length, and rounded quite through, leaving only the lower part, *a a*, square.

The heeling.—The heeling is made so as to conform to the space between the cross-trees and trestle-trees, which is the same to the top-gallant mast, as has been explained for the topmast.

The fid-hole.—The lower part is one diameter and one inch up from the heel; for the up and down way half the diameter, and athwart-ships two-thirds of what it is up and down.

The sheave-hole for the top-rope.—There is one sheave-hole placed in the starboard foremost eight-square, with its lower part three diameters from the lower end, and in length one diameter and one sixth.

The sheave-holes for top-gallant and royal ties.—Sheave-holes are cut in a fore-and-aft direction, half the diameter below each of the stops; the length of them is equal to the diameters at the stops and one sixth, and are lined with copper.

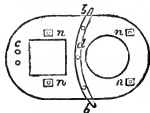


STUMP-POLE TOP-GALLANT MASTS.

Top-gallant masts are sometimes fitted with stump poles, when they frequently have a sliding gunter-mast fitted to them. The length is set off and formed the same as the top-gallant and royal masts in one, excepting that above the stop is a long pole head. The diameter of the extreme end of the pole is half the given diameter.

CAPS ON THE LOWER MASTS.

The principal caps of a ship are those of the lower masts, made of African oak, in the merchant service; they are in breadth equal to twice, and in thickness five-sixths the diameter of the top-mast. Two large holes are cut through them, the one square to fit on the lower mast-head, the other round, for the top-mast to slide through. The caps are trimmed or sawed to their dimensions, and their upper and under sides made straight and out of winding, and the ends are rounded off to an arc of a circle, the sides with a small curve. The holes are set off from the centre of the under side of the cap at equal distances; the substance of wood



left between the holes to be half the taper of the mast head, and the thickness of the chock between the trestle-trees. The round hole is the foremost one for the top-mast, and is swept to seven-eighths of an inch larger than the diameter, to allow for the thickness of the leather, and one-eighth of an inch for play. The square hole is set off $\frac{1}{8}$ fore-and-aft, and $\frac{3}{16}$ athwart-ships, of the size of the tenon on the mast head, and tapered one inch to a foot, the fore part and each side three-eighths of an inch to a foot, and the after part square, towards the upper side of the cap: this is done for what is termed "strengthening down." The wood before the round hole is two-thirds the depth of the cap, and the wood left beyond the after part of the square hole is once the depth of the cap. The depth is usually reduced on the edge of the cap $\frac{1}{2}$, to make it as light as possible. The iron-hoop round the cap is commonly one-third its depth, and varies in thickness from one-fourth to five-eighths of an inch, according to the size of the cap.

These caps have four eye-bolts, *n*, driven through the cap from the under side for the top-rope-pendants, &c. One of the bolts is placed on each side of the square hole near the edge of the cap on the under side, and one on each side of the round hole; at the fore part, with their eyes athwart-ships and well clenched upon an iron-plate let into the upper side of the cap. On the upper side is also a plate, *d*, for the lower lifts, with an eye in each end; it is in breadth about one-third the depth of the cap, and in thickness from one-quarter to five-eighths of an inch. Three bolts are driven to secure it on. All caps have horizontal strengthening bolts driven through them and clenched.

To let on the caps of the lower masts.—From the square hole cut in the cap, take the size at the lower side, and as the cap is not to go down to the shoulders on the first letting on within an inch and a half, for the shrinking of each, the size of the tenon is that distance set off; when this is done, take the size of the upper part of the hole and depth, and trim the head of the mast to the size. It is to be observed that all caps are to be raised above a level from the middle line on the mast to resist the weights that act on the fore side of them.

TOPMAST CAP.

The proportion of the topmast cap to the diameter of the top-gallant mast is the same as the preceding to the topmast. Two holes are formed, the one square to fit the topmast head, the other round for the top gallant mast. They have four eye-bolts, *e e e e*, driven similar to



the lower cap, and the cap is iron bound as described for the lower cap. See also sketch at page 24.

Several vessels in the merchant service have got *iron caps* fitted on the mast-heads and on the bowsprit-end. The cap of the bowsprit in this case is fitted on *square* on the end, and the hole is round for the jibboom going through. These *iron caps* look uncommonly snug and light, and seem to answer their purpose well.

CHAPTER V.

On Yards made of Single Trees.—On Main and Fore-yards.—On Topsail Yards.—On Cross-jack Yards, Spritenail Yards, Top-gallant Yards, Royal Yards, and Studding-sail Yards.—On the Driver, or Spanker, and Main Booms.—On the Mizzen and Main Gaffs.—On Trysail Masts.—Studding-sail Booms.—Trestle-trees and Cross-trees for Lower Masts.—The Framing of the Trestle and Cross-trees.—Tops of Merchant Ships.—Top-mast Trestle and Cross-trees.

ON YARDS MADE OF SINGLE TREES.

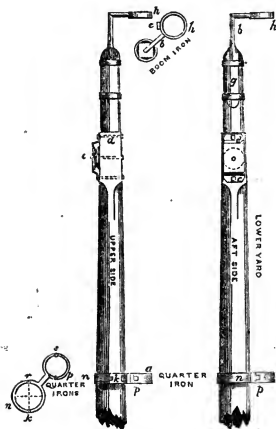
YARDS are either square, lateen, or lug-sail; the first are suspended across the mast at right angles, and the two latter obliquely. The square yards are of a cylindrical form, tapering from the middle, which is termed the slings, towards the extremities, which are called the yard-arms, and at the slings is the place of the given diameter; the distance between the slings and the yard-arms on each side is quartered, which are distinguished into the first, second, and third quarters, and yard-arms.

ON MAIN AND FORE-YARDS.

The middle quarters are formed into eight squares, the after square to half the length of the yard, or to one foot six inches beyond the quarter iron for after batten, and the others, which are for the sling hoop and truss, one-eighth the length of the yard, and from the eight squares in the middle each side is rounded to the outer ends, except at the place of the sheave-holes in their arms for the topsail sheets, which are left square the length of the sheave-hole. It is to be observed, however, that sheave-holes weaken the yards, and an iron cheek block, *c*, is far superior, being brought on the after side, even with the stops, *d*, for the topsail sheet.

The stops, *d d*, are formed out of the yards, in squaring for the cheek blocks. Yards are fitted at their outer ends for rigging out studdingsail-booms, with four *boom-irons*; there

are two on each side of the yard; the outer one is named the *yard-arm-iron*, *b h*, and the inner one, which is placed at $\frac{1}{8}$ the length of the yard from the outer end, the *quarter-iron*, *n*. The outer boom-iron is composed of two parts, the *strap*, *g*, which is let in the thickness lengthways upon the yard-



arm, and the crank, *b h*, which projects at right-angles to the strap, having a ring, *h*, connected to it, for the boom: in one side of this ring a horizontal lignum vitæ roller, *e*, is fixed, for the ease of sliding out the booms. The inner irons or quarter-irons, differ in shape to the yard-arm-iron. One part is formed as a clasp hoop to compass the yard, *r k n*, and the ring, *s p*, is separated from it by a shank or chock: the upper part of the ring opens with a hinge, *s*, and key,

p, for fastening it when the heel of the boom is laid therein.

The boom-irons are fixed on the yards so that a line drawn through the middle of the shanks of each may pass through the angle formed by the foremost eight-square, and foremost upper eight-square, and the centre of any section of the yard. The outer boom-irons let in their thickness at each end of the yard, and are fastened with two hoops driven on tight, with a bolt through between them, and two nails in the ends. The quarter-irons are put on warmed, and the keys driven in.

Boom-irons on the yard-arms of small ships have a straight neck, projecting from straps, with a shoulder in the middle of the neck, and the part without left square. The ring has a shank on the under part, with a square hole that fits the neck, and is there secured by a screw-nut or a spring forelock that goes on the neck next the ring. It is principally large vessels that have quarter-irons on their yards.

ON TOP-SAIL YARDS.

Top-sail yards are of a cylindrical form, tapering from the slings or given diameter towards the ends or yard-arms. The ends are three-sevenths to one-half the given diameter; and the eight squares left on each side of the middle are one-eighth of the given length of the yard, and each side being trimmed sixteen-square, are rounded and planed smooth and fair to their outer ends, except at the places of the sheave-holes, for the top gallant-sheets, which are left square, and cleats or stops raised from the solid, for the reefs of the topsail. These yards have a sheave-hole cut from the upper side its length within each outer end for the reef tackles; and in some merchant ships, sheave-holes are cut for the top gallant-sheets, but a cheek-block fixed on the after side, as shown on the lower-yards, is to be preferred, as sheave-holes weaken the yards.

Finishing of Yards.—Top-sail yards are fitted at the middle with two hoops once the diameter of the yard on each side of the slings, for the topsail ties.

The fore and main top-sail yards commonly have boom-irons at their outer ends, with the outer arm or crank of the iron made to ship and unship. The mizen top-sail yard has no boom-iron, but a ferrule driven on, and an eye driven into the end of the yard.

ON CROSS-JACK YARDS, SPRIT-SAIL YARDS, TOP-GALLANT YARDS, ROYAL YARDS, AND STUDDING-SAIL YARDS.

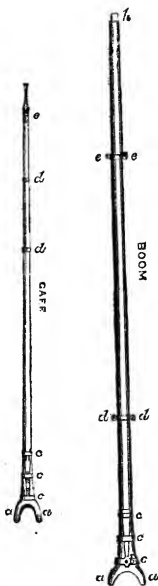
These yards are at the ends three-sevenths of the diameter at the slings, and are left in the eight squares at the middle one-fourth their length, and each side sixteen squares, then rounded and planed fair and smooth throughout the length, and a ferrule and eye at each end. Stops are formed out of the yard the same as the top-sail yards, and a hoop in the middle for the slings.

ON THE DRIVER OR SPANKER AND MAIN-BOOMS

The given diameter of *driver-booms* is at the middle, and of *main sail-booms* at the sheet or taffrail; their outer ends are two-thirds, and the inner ends three-fourths of the given diameter. They are then lined to the size and rounded all the way through, except for the jaws, *a a*, where it is left square. The jaws are mostly made of oak, and are formed to a half-circle, 1 inch larger than the diameter of the mast, for leather and play: they are in length from 4 to 5 feet from the inner end of the boom, and in depth $\frac{3}{4}$ to 1 inch less than the diameter of the fore-end. The boom is worked to a tongue to which the jaws are scarphed; they are then formed with a curve inwards, so as to follow in fair to the size of the boom, leaving sufficient strength to the hollow of the jaws, and are then rounded each way the fore-ends. Three or four hoops, *c c c*, are driven over the jaws, and under the third hoop from the fore-end a horizontal bolt is driven through the boom and both parts of the jaws, and one strengthening bolt is also driven about $2\frac{1}{2}$ inches from the hollow; the ends have a nail driven on each side through the jaws into the boom.

Some spanker-booms have no jaws attached to them, but fitted with a goose-neck at the inner end, and a hoop round the mast with an eye to receive it. At the outer end is formed a necking *h*, and has a sheave-hole cut within for the clue of the sail hauling out to the boom-end; one, and sometimes two, hoops with eyes, *d, e*, for the topping-lift; *e*, for the outer, and *d*, for the inner, when it is a long boom.

ON THE MIZEN AND MAIN GAFFS.



The given diameter of gaffs is at four feet from the inner end, and their lengths are set up from the butt on the upper part; their outer ends are half to five-ninths of the given diameter. They are then lined to the size and rounded, as before. The jaws, *a a*, are made and finished similar to the booms, except that the hollow of the jaws have a great beveling, that it may be in the direction of the mast, when peaked. An eye-bolt is driven through from the upper side in the direction of the beveling of the inner end, and clenched underneath, for the throat halyards, and one small eye-bolt with a hook fitted to it driven from the underside, for hooking the neck-earring, and securing the throat down-hauler; the jaws are always leathered in the hollow. At the end of the gaff there is a ferrule and eye, up and down, for fixing a small block to for displaying signals. There are likewise hoops with eyes, *d d*, driven on the gaff for the peak halyards.

When the gaff is a "fixed-gaff," there is a goose-neck fitted at the inner-end. *Fore* and *Main-trysail-gaffs* are generally fitted in that manner, which works in the truss-hoop having an eye to receive it; their given diameter is

at the inner end, and the outer end is three-fifths of the

given diameter. There is no additional length allowed for pole; and a sheave is cut through at the outer end. A ferrule and eye are fitted the same as those of the mizen-gaff.

ON TRY-SAIL-MASTS.

Try-sail-masts are seldom made for ships or barques, but only brigs, termed *snows*, being that they are equipped with a third small mast or try-sail-mast, just abaft the main-mast to carry a sail similar to a ship's spanker. The try-sail-mast is rounded all the way through, and is of an equal diameter the whole length, from one-third to one-half the diameter of the main-mast. The foot of this mast is sometimes fixed in a block of wood, or kind of step, upon the deck; at other times on the boom; and, commonly, steps on a clasp-hoop, with an eye to receive it: the head is secured between the after part of the trestle-trees. Instead of a try-sail-mast, a thick rope called a horse, is mostly used for attaching the fore-leeches of main and fore-try-sails in a ship or a barque.

STUDDING-SAIL-BOOMS.

The given diameter of swinging or lower studding-sail-booms is at the heel and one-third the length, between which they are made parallel, and decrease from thence to two-thirds the given diameter. They are rounded the whole length, and have a necking at the outer-end, and a hole bored through the diameter within; the inner end is fitted with a goose-neck and ferrule.

The top and top-gallant studding-sail-booms have the given diameter at one-third from each end: the ends are two-thirds of the given diameter, and rounded the whole length, and have a hole through the end.

TRESTLE-TREES AND CROSS-TREES FOR LOWER MASTS.

The *trestle-trees* are in length equal to the breadth of the top fore-and-aft; in depth, half the diameter of the mast at the partners; and in breadth or thickness, one-half of the depth. The insides are trimmed straight and out of winding, and the breadth set off parallel to them. The lower sides are snaped from half the depth of the trestle-

trees down to one and three-fourths of the depth in length, from the fore end, and one and three-sevenths of the depth from the after end, and rounded to a half-circle at the foremost-ends; the lower edges are chamfered the whole length.

The *cross-trees* are in length the breadth of the top; the breadth,—the breadth of the trestle-trees; and, the depth or thickness, two-thirds of their breadth: they are snaped from half their depth down at the ends to one-fourth of the length of the cross-trees, and their ends rounded off with a sweep; a chamfer is taken off the edges on the under sides and round the ends the length of the snapes.

THE FRAMING OF THE TRESTLE AND CROSS-TREES.

The trestle-trees are placed on horizontal thawts or blocks, and kept apart the breadth of the mast-head athwartships, and square with each other at the ends; the cross-trees are next laid, at their proper stations, athwart the upper sides of the trestle-trees, having the middle of their lengths in the centre between the trestle-trees, and at right angles with them. In letting down the cross-trees, scores are cut in the trestle-trees from three-fourths of an inch to one inch of their depth; a score is also taken out of the under sides of the cross-trees to the breadth, and half the depth on the trestle-trees, to steady them in their places. The cross-trees are then removed, to let up chocks, which are brought on the fore and after sides of the mast between the trestle trees, and of the same depth. It is only in large ships these chocks are fit in the trestle-trees. When the cross-trees are in their places, one saucer-headed bolt is driven through each from the upper side, and screwed-nutted on the under side of the trestle-trees.

TOPS OF MERCHANT-SHIPS.

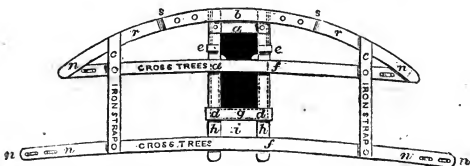
All tops in the merchant service are made as small and light as possible, in order to reduce the *chafing* of the top-sails against the top rim. The usual length is two-thirds to one-half of their breadth; and the *breadth* of main-top is about equal to one half the moulded breadth of beam; the *breadth* of fore-top nine-tenths of main-top; and *breadth* of mizen-top four-fifths of fore-top. It is not considered

necessary to make tops broad for the spread of the top-mast rigging, as it is found now that a good stout *standing backstay* is the main support of the top-mast.

The fore part of tops are of an elliptical form, and a rim of elm or oak board fixed on the cross and trestle-trees, give the external form, when it is either boarded or grated. The framing being formed, iron plates are let in for the puttock-plates: the foremost hole for the puttock-plates is fixed at the centre of the top-mast; the after hole is about six inches from the after part of the top; and the intermediate ones are equally spaced. A hole is cut for the slings at the fore part of the top.

TOP-MAST TRESTLE AND CROSS-TREES.

The length of the *trestle-trees* should be governed by the cross-trees and chocks; the breadth $\frac{1}{2}$ of lower trestle-trees of the respective masts; and the depth $\frac{1}{2}$ of the depth of lower trestle-trees. The *cross-trees*, when curved,



have the proportion thus,—length of after horn, four-sixths of the lower after cross-trees of the respective masts; length of the forward horn, five-sixths of the after one; breadth,—the breadth of the trestle-trees; and, the depth or thickness, four-fifths of the breadth. The horns usually sweep 9 inches in 16 feet.

The trestle-trees are trimmed similar to the lower ones, and snapped at the ends; and the cross-trees have a taper on the under sides to half the depth at the ends, which are rounded, and a hole bored 3 or 4 inches within, for the top-gallant shrouds; instead of a hole, is sometimes a small roller fixed.

The cross-trees and trestle-trees are united together similar to the lower ones, in a frame; and when they are made with a circular piece, *r r*, it is secured to the fore-end of the trestle-trees, *h h*, and to the outer part of the forward horned cross-trees, *f*; a span piece, *b*, unites the two pieces together with four up and down bolts. The short cross piece *a*, between the trestle-trees let down, is bolted to the circular pieces with two small bolts. In fore-top-mast trestle-trees of the navy there is an additional length allowed to them, to give a larger space, *i*, between the top-mast and after-mast cross-tree, for a block for the main top-gallant stay to lead through. The cross-trees and circular pieces *r r*, are connected by an iron strap fixed to them, which is made that it may easily be unfixed.

CHAPTER VI.

Preliminary Remarks.—On Mastng Merchant-ships.—Observations on the Diameters and Forms of Masts, Yards, &c.—The greatest Diameter, commonly called the *given Diameter*, where it is situated.—Proportions that the Diameters usually bear to the respective length of the Masts, Yards, &c.—The fractional proportion that the intermediate Diameters bear towards the given Diameter.—Tables of dimensions of Masts and Yards in the Merchant Service.

HAVING extended the practical operations in mast-making over as many pages as the limits of this work will admit, and, it is hoped, as will be sufficient for initiating the young student into the rudiments of this art, a few observations may be added respecting the mastng of ships in the Merchant Service.

In the first place it is proper to observe, that in determining the masts and yards for merchant-ships, no general rule seems to be practised, as we find numerous ships in the same trade, of the same dimensions, and (to appearance) of the same stability, with very dissimilar masts and yards. This in some degree may be accounted for, by the mastng and sparring of these ships being often regulated by the opinions of those persons who are to command them, some-

times to the fancy of the owner, and at other times to the builder. This matter of tastes has not only caused a great difference in the dimensions of masts and yards for similar ships, but as great a variety in the tautness of the masts and the squareness of the yards; which, go to prove that there is not the proportion maintained of the masts and yards to the length and breadth of the ship, as is the practice in the British Navy.

The rules given by different authors for determining the proportion of masts, yards, &c., for merchant-ships, are of very little use now, for there are so many varieties in the build of these ships,—some very long and narrow, and others both long and broad, that it is impossible to make one rule serve in both cases; and it would require a great number of rules to determine the proportion of masts and yards, the way at present these ships are rigged. It is not intended in this work to give rules, as it is more common now to delineate a plan of the sails, from dimensions of masts and yards of the most approved rig the same size, or thereabouts, and vary them as may be considered necessary for the trade she is to be employed in, and for the number of men that have to work the sails. This is decidedly the best method to adopt for ships of any kind, as it will be seen upon the plan how the masts and yards look in proportion to the size of the vessel; besides, the calculation of the centre of effort of the sails can easily be found, and compared with other ships that have been known to answer well.

ON THE DIAMETERS AND FORMS OF MASTS, YARDS, &c.

In ascertaining what strength and form should be given to the several spars made use of in masting of ships, so that a proper maintenance may be afforded for resisting the strains that masts, yards, &c., are subject to, we must be guided by our knowledge on the effects produced on the different descriptions of timbers, and by what experience and much service have found to be best, rather than by any speculative theory. It is from observations of this sort that the mast-maker has been enabled to form such a judgment respecting the strength and diameters that are requisite for all masts, yards, &c., and to form rules from experience, as to be pretty correct and easy of application.

The largest diameter is that which is *given*, and is taken thus:—at the partners or decks of lower masts; at the cap,

in top-masts and top-gallant-masts; at the bed, of bowsprits; at the slings or middle, of yards; at the bowsprit-cap, of jib-booms; at the middle, of driver-booms; at the sheet or taffrail, of main-sail-booms; at four feet from the end, of gaffs; at one-third from each end of top and top-gallant studding-sail-booms; and, at one-third from the inner-end of swing or lower studding-sail-booms.

PROPORTIONS THAT THE DIAMETERS USUALLY BEAR TO THE RESPECTIVE LENGTH OF THE MASTS, YARDS, &C.

The diameters given to masts, yards, &c., commonly follow some law of their length, thus:—

Diameters of Masts.

Main and fore-masts, one inch for every three feet of the length.

Main-masts of brigs, one inch to every three feet in length; and the *fore-mast* nine-tenths of the diameter of the main-mast.

Masts of cutters, three-fourths of an inch in diameter to every three feet in length.

Mizen masts of ships, two-thirds of the diameter of the main-mast.

Main and fore-top-masts, one inch to every three feet in length.

Mizen top-masts, seven-tenths of the diameter of the main-top-mast.

Top-gallant-masts, one inch to every three feet in their length.

Royal-masts, two-thirds the diameter of their top-gallant masts.

Bow-sprits, the same diameter as the main-mast.

Diameters of Yards.

Main and fore-yards, at the slings or middle, seven-tenths to seven-eighths of an inch to every three feet in the length.

Top-sail-yards, five-eighths to seven-eighths of an inch to every three feet in the length.

Top-gallant-yards, six-tenths to five-eighths of an inch to every three feet in the length.

Royal-yards, one-half the diameter of their top-sail yards.

Studding-sail-yards, one inch in diameter to every five feet in the length.

Diameters of Booms.

Studding-sail-booms, one inch to every five feet in the length.

Jib-booms, seven eighths of an inch to every three feet in the length.

Flying-jib-booms, seven-eighths of an inch to every three feet in the length.

Driver-booms, the same as the fore-top-sail-yard.

Gaffs, the same as their booms.

TABLE OF THE FRACTIONAL PROPORTION THAT THE INTERMEDIATE DIAMETERS BEAR TOWARDS THE GIVEN DIAMETER.

Species of Masts, Yards, &c.	Proportions to the given Diameter.					
	Quarters.			Head.		Heel.
	1st.	2nd.	3rd.	Lower Part.	Upper Part.	
Standing-masts	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{2}{3}$
Topmasts, topgallant-masts, and royal-masts. }	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{1}{2}$	...
Yards	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{3}$	Arms. $\frac{2}{3}$	...	..
Bowsprit	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{3}$	...	Outer-end. $\frac{2}{3}$
Jib and driver-booms	$\frac{4}{5}$	$\frac{1}{2}$	$\frac{2}{3}$	Ends. $\frac{2}{3}$	...	...
Main-booms	$\frac{4}{5}$	$\frac{1}{2}$	$\frac{2}{3}$	Fore-end. $\frac{2}{3}$	After-end. $\frac{2}{3}$	Middle. $\frac{1}{2}$
Gaffs	$\frac{4}{5}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	...	...
Heeling { Standing-masts } { Bowsprit . . . }	$\frac{2}{3}$ athwartship.			...	$\frac{1}{2}$ fore and aft.	
	$\frac{1}{2}$ "			$\frac{2}{3}$ up and down.		

DIAMETERS OF LOWER MASTS AT THEIR QUARTERS, HEADS, AND HEELS.

Given Diameter.	Quarters.			Heads.		Heels.	Given Diameter.	Quarters.			Heads.		Heels.
	80	1 $\frac{1}{2}$	9	4 $\frac{1}{2}$	5 $\frac{1}{2}$			80	1 $\frac{1}{2}$	9	4 $\frac{1}{2}$	5 $\frac{1}{2}$	
	1st.	2nd.	3rd.	Hounds.	Head.			1st.	2nd.	3rd.	Hounds.	Head.	
Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
32	31 $\frac{1}{2}$	29 $\frac{3}{4}$	27 $\frac{1}{2}$	24	20	27 $\frac{1}{2}$	20	19 $\frac{3}{4}$	18 $\frac{3}{4}$	17 $\frac{1}{2}$	15	12 $\frac{1}{2}$	17 $\frac{1}{2}$
31 $\frac{1}{2}$	31	29 $\frac{1}{2}$	27	23 $\frac{1}{2}$	19 $\frac{1}{2}$	27	19 $\frac{1}{2}$	19 $\frac{1}{2}$	18 $\frac{1}{2}$	16 $\frac{3}{4}$	14 $\frac{1}{2}$	12 $\frac{1}{2}$	16 $\frac{3}{4}$
31	30 $\frac{1}{2}$	28 $\frac{1}{2}$	26 $\frac{1}{2}$	23 $\frac{1}{4}$	19 $\frac{1}{4}$	26 $\frac{1}{2}$	19	18 $\frac{3}{4}$	17 $\frac{3}{4}$	16 $\frac{1}{4}$	14 $\frac{1}{4}$	11 $\frac{3}{4}$	16 $\frac{1}{4}$
30 $\frac{1}{2}$	30	28 $\frac{1}{4}$	26	22 $\frac{1}{2}$	19 $\frac{1}{4}$	26	18 $\frac{1}{2}$	18 $\frac{1}{2}$	17 $\frac{1}{2}$	15 $\frac{3}{4}$	13 $\frac{3}{4}$	11 $\frac{1}{2}$	15 $\frac{3}{4}$
30	29 $\frac{1}{2}$	28	25 $\frac{3}{4}$	22 $\frac{1}{4}$	18 $\frac{3}{4}$	25 $\frac{3}{4}$	18	17 $\frac{3}{4}$	16 $\frac{3}{4}$	15 $\frac{1}{2}$	13 $\frac{1}{2}$	11 $\frac{1}{4}$	15 $\frac{1}{2}$
29 $\frac{1}{2}$	29	27 $\frac{1}{2}$	25 $\frac{1}{2}$	22 $\frac{1}{4}$	18 $\frac{1}{2}$	25 $\frac{1}{2}$	17 $\frac{1}{2}$	17 $\frac{1}{2}$	16 $\frac{1}{2}$	15	13 $\frac{1}{2}$	11	15
29	28 $\frac{1}{2}$	27	24 $\frac{1}{2}$	21 $\frac{3}{4}$	18 $\frac{1}{4}$	24 $\frac{1}{2}$	17	16 $\frac{3}{4}$	15 $\frac{3}{4}$	14 $\frac{1}{2}$	12 $\frac{3}{4}$	10 $\frac{3}{4}$	14 $\frac{1}{2}$
28 $\frac{1}{2}$	28	26 $\frac{1}{2}$	24 $\frac{1}{4}$	21 $\frac{1}{2}$	17 $\frac{3}{4}$	24 $\frac{1}{4}$	16 $\frac{1}{2}$	16 $\frac{1}{2}$	15 $\frac{1}{2}$	14 $\frac{1}{4}$	12 $\frac{1}{2}$	10 $\frac{1}{2}$	14 $\frac{1}{4}$
28	27 $\frac{1}{2}$	26 $\frac{1}{4}$	24	21	17 $\frac{1}{2}$	24	16	15 $\frac{3}{4}$	14 $\frac{3}{4}$	13 $\frac{3}{4}$	12	10	13 $\frac{3}{4}$
27 $\frac{1}{2}$	27	25 $\frac{1}{2}$	23 $\frac{1}{2}$	20 $\frac{3}{4}$	17 $\frac{1}{4}$	23 $\frac{1}{2}$	15 $\frac{1}{2}$	15 $\frac{1}{2}$	14 $\frac{1}{2}$	13 $\frac{1}{2}$	11 $\frac{1}{2}$	9 $\frac{3}{4}$	13 $\frac{1}{2}$
27	26 $\frac{1}{2}$	25 $\frac{1}{4}$	23 $\frac{1}{4}$	20 $\frac{1}{2}$	16 $\frac{3}{4}$	23 $\frac{1}{4}$	15	14 $\frac{3}{4}$	14	12 $\frac{3}{4}$	11 $\frac{1}{4}$	9 $\frac{1}{2}$	12 $\frac{3}{4}$
26 $\frac{1}{2}$	26	24 $\frac{3}{4}$	22 $\frac{3}{4}$	19 $\frac{3}{4}$	16 $\frac{1}{2}$	22 $\frac{3}{4}$	14 $\frac{1}{2}$	14 $\frac{1}{2}$	13 $\frac{1}{2}$	12 $\frac{1}{2}$	10 $\frac{1}{2}$	9 $\frac{1}{4}$	12 $\frac{1}{2}$
26	25 $\frac{1}{2}$	24 $\frac{1}{2}$	22 $\frac{1}{2}$	19 $\frac{1}{2}$	16 $\frac{1}{4}$	22 $\frac{1}{2}$	14	13 $\frac{3}{4}$	13	12	10 $\frac{1}{4}$	8 $\frac{3}{4}$	12
25 $\frac{1}{2}$	25	23 $\frac{3}{4}$	21 $\frac{3}{4}$	19 $\frac{1}{4}$	15 $\frac{3}{4}$	21 $\frac{3}{4}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	12 $\frac{1}{2}$	11 $\frac{1}{2}$	10 $\frac{1}{2}$	8 $\frac{1}{2}$	11 $\frac{1}{2}$
25	24 $\frac{1}{2}$	23 $\frac{1}{4}$	21 $\frac{1}{4}$	18 $\frac{3}{4}$	15 $\frac{1}{2}$	21 $\frac{1}{2}$	13	12 $\frac{3}{4}$	12 $\frac{1}{2}$	11 $\frac{1}{4}$	9 $\frac{3}{4}$	8 $\frac{1}{4}$	11 $\frac{1}{4}$
24 $\frac{1}{2}$	24	22 $\frac{3}{4}$	21	18 $\frac{1}{2}$	15 $\frac{1}{4}$	21	12 $\frac{1}{2}$	12 $\frac{1}{2}$	11 $\frac{1}{2}$	10 $\frac{3}{4}$	9 $\frac{1}{2}$	7 $\frac{3}{4}$	10 $\frac{3}{4}$
24	23 $\frac{1}{2}$	22 $\frac{1}{2}$	20 $\frac{1}{2}$	18	15	20 $\frac{1}{2}$	12	11 $\frac{3}{4}$	11 $\frac{1}{2}$	10 $\frac{1}{2}$	9	7 $\frac{1}{2}$	10 $\frac{1}{2}$
23 $\frac{1}{2}$	23 $\frac{1}{4}$	21 $\frac{3}{4}$	20 $\frac{1}{4}$	17 $\frac{3}{4}$	14 $\frac{3}{4}$	20 $\frac{1}{4}$	11 $\frac{1}{2}$	11 $\frac{1}{4}$	10 $\frac{3}{4}$	9 $\frac{3}{4}$	8 $\frac{3}{4}$	7 $\frac{1}{4}$	9 $\frac{3}{4}$
23	22 $\frac{3}{4}$	21 $\frac{1}{2}$	19 $\frac{3}{4}$	17 $\frac{1}{2}$	14 $\frac{1}{2}$	19 $\frac{3}{4}$	11	10 $\frac{3}{4}$	10 $\frac{1}{2}$	9 $\frac{1}{2}$	8 $\frac{1}{2}$	6 $\frac{3}{4}$	9 $\frac{1}{2}$
22 $\frac{3}{4}$	22 $\frac{1}{2}$	21	19 $\frac{1}{4}$	16 $\frac{3}{4}$	14 $\frac{1}{4}$	19 $\frac{1}{4}$	10 $\frac{1}{2}$	10 $\frac{1}{4}$	9 $\frac{3}{4}$	9	7 $\frac{3}{4}$	6 $\frac{1}{2}$	9
22	21 $\frac{3}{4}$	20 $\frac{3}{4}$	18 $\frac{3}{4}$	16 $\frac{1}{2}$	13 $\frac{3}{4}$	18 $\frac{3}{4}$	10	9 $\frac{3}{4}$	9 $\frac{1}{2}$	8 $\frac{3}{4}$	7 $\frac{1}{2}$	6 $\frac{1}{4}$	8 $\frac{3}{4}$
21 $\frac{3}{4}$	21 $\frac{1}{2}$	20	18 $\frac{1}{2}$	16 $\frac{1}{4}$	13 $\frac{1}{2}$	18 $\frac{1}{2}$	9 $\frac{1}{2}$	9 $\frac{1}{4}$	8 $\frac{1}{2}$	8 $\frac{1}{4}$	7 $\frac{1}{4}$	5 $\frac{3}{4}$	8 $\frac{1}{4}$
21	20 $\frac{3}{4}$	19 $\frac{3}{4}$	18	15 $\frac{3}{4}$	13 $\frac{1}{4}$	18	9	8 $\frac{3}{4}$	8 $\frac{1}{4}$	7 $\frac{3}{4}$	6 $\frac{3}{4}$	5 $\frac{1}{2}$	7 $\frac{3}{4}$
20 $\frac{3}{4}$	20 $\frac{1}{2}$	19 $\frac{1}{2}$	17 $\frac{1}{2}$	15 $\frac{1}{2}$	12 $\frac{3}{4}$	17 $\frac{1}{2}$							

DIAMETERS OF TOP-MASTS, TOP-GALLANT-MASTS, AND ROYAL-MASTS, AT THEIR QUARTERS AND HEADS.

Diameter at the Cap.	Quarters.			Heads.		Diameter at the Cap.	Quarters.			Heads.	
	$\frac{20}{11}$	$\frac{14}{11}$	$\frac{9}{11}$	$\frac{13}{11}$	$\frac{11}{11}$		$\frac{20}{11}$	$\frac{14}{11}$	$\frac{9}{11}$	$\frac{13}{11}$	$\frac{11}{11}$
	1st.	2nd.	3rd.	Hounds.	Head.		1st.	2nd.	3rd.	Hounds.	Head.
19	18 $\frac{1}{2}$	17 $\frac{1}{2}$	16 $\frac{1}{2}$	13 $\frac{1}{2}$	10 $\frac{3}{4}$	11	10 $\frac{1}{2}$	10 $\frac{1}{2}$	9 $\frac{1}{2}$	7 $\frac{1}{2}$	6
18 $\frac{1}{2}$	18 $\frac{1}{2}$	17 $\frac{1}{2}$	15 $\frac{3}{4}$	12 $\frac{1}{2}$	10 $\frac{1}{2}$	10 $\frac{1}{2}$	10 $\frac{1}{2}$	9 $\frac{1}{2}$	9	7 $\frac{1}{2}$	5 $\frac{3}{4}$
18	17 $\frac{1}{2}$	16 $\frac{3}{4}$	15 $\frac{1}{2}$	12 $\frac{1}{2}$	9 $\frac{1}{2}$	10	9 $\frac{1}{2}$	9 $\frac{1}{2}$	8 $\frac{1}{2}$	6 $\frac{1}{2}$	5 $\frac{1}{2}$
17 $\frac{1}{2}$	17 $\frac{1}{2}$	16 $\frac{1}{2}$	15	12 $\frac{1}{2}$	9 $\frac{1}{2}$	9 $\frac{1}{2}$	9 $\frac{1}{2}$	8 $\frac{1}{2}$	8 $\frac{1}{2}$	6 $\frac{1}{2}$	5 $\frac{1}{2}$
17	16 $\frac{3}{4}$	15 $\frac{1}{2}$	14 $\frac{1}{2}$	11 $\frac{1}{2}$	9 $\frac{1}{2}$	9	8 $\frac{1}{2}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$	6 $\frac{1}{2}$	5
16 $\frac{1}{2}$	16 $\frac{1}{2}$	15 $\frac{3}{4}$	14 $\frac{1}{2}$	11 $\frac{1}{2}$	9	8 $\frac{1}{2}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$	7 $\frac{1}{2}$	5 $\frac{1}{2}$	4 $\frac{1}{2}$
16	15 $\frac{3}{4}$	14 $\frac{3}{4}$	13 $\frac{3}{4}$	11 $\frac{1}{4}$	8 $\frac{1}{2}$	8	7 $\frac{1}{2}$	7 $\frac{1}{4}$	6 $\frac{1}{2}$	5 $\frac{1}{2}$	4 $\frac{1}{2}$
15 $\frac{1}{2}$	15 $\frac{1}{2}$	14 $\frac{1}{2}$	13 $\frac{1}{2}$	10 $\frac{3}{4}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$	7 $\frac{1}{2}$	7	6 $\frac{1}{2}$	5 $\frac{1}{2}$	4 $\frac{1}{2}$
15	14 $\frac{3}{4}$	14	12 $\frac{3}{4}$	10 $\frac{3}{4}$	8 $\frac{1}{2}$	7	6 $\frac{1}{2}$	6 $\frac{1}{2}$	6	4 $\frac{1}{2}$	3 $\frac{3}{4}$
14 $\frac{1}{2}$	14 $\frac{1}{2}$	13 $\frac{1}{2}$	12 $\frac{1}{2}$	10	7 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{4}$	5 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$
14	13 $\frac{3}{4}$	13	12	9 $\frac{3}{4}$	7 $\frac{1}{2}$	6	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$
13 $\frac{1}{2}$	13 $\frac{1}{2}$	12 $\frac{1}{2}$	11 $\frac{1}{2}$	9 $\frac{1}{2}$	7 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3
13	12 $\frac{3}{4}$	12 $\frac{1}{4}$	11 $\frac{1}{4}$	9	7 $\frac{1}{2}$	5	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{4}$	2 $\frac{3}{4}$
12 $\frac{1}{2}$	12 $\frac{1}{2}$	11 $\frac{1}{2}$	10 $\frac{1}{2}$	8 $\frac{1}{2}$	6 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	2 $\frac{1}{2}$
12	11 $\frac{3}{4}$	11 $\frac{1}{4}$	10 $\frac{1}{4}$	8 $\frac{1}{4}$	6 $\frac{1}{2}$	4	3 $\frac{3}{4}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	2 $\frac{3}{4}$	2 $\frac{1}{4}$
11 $\frac{1}{2}$	11 $\frac{1}{2}$	10 $\frac{1}{2}$	9 $\frac{1}{2}$	7 $\frac{1}{2}$	6 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3	2 $\frac{1}{2}$	1 $\frac{1}{2}$

DIAMETERS OF THE BOWSPRITS, AT THEIR QUARTERS, ETC.

Diameter at the Bed.	Quarters.			Outer End.	Heels.	Diameter at the Bed.	Quarters.			Outer End.	Heels.
	2 ^d	1 st	3 ^d				2 ^d	1 st	3 ^d		
	1st.	2nd.	3rd.				1st.	2nd.	3rd.		
Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
31	30 $\frac{1}{2}$	28 $\frac{1}{2}$	24 $\frac{3}{4}$	20 $\frac{1}{2}$	26 $\frac{1}{2}$	21 $\frac{1}{2}$	21 $\frac{1}{2}$	19 $\frac{3}{4}$	17 $\frac{1}{2}$	14 $\frac{3}{4}$	18 $\frac{3}{4}$
30 $\frac{1}{2}$	30	28	24 $\frac{1}{2}$	20 $\frac{1}{2}$	26	21	20 $\frac{1}{2}$	19 $\frac{1}{2}$	16 $\frac{3}{4}$	14	18
30	29 $\frac{1}{2}$	27 $\frac{1}{2}$	24	20	25 $\frac{3}{4}$	20 $\frac{1}{2}$	20 $\frac{1}{2}$	18 $\frac{1}{2}$	16 $\frac{1}{2}$	13 $\frac{1}{2}$	17 $\frac{1}{2}$
29 $\frac{1}{2}$	29	27	23 $\frac{1}{2}$	19 $\frac{1}{2}$	25 $\frac{1}{2}$	20	19 $\frac{3}{4}$	18 $\frac{1}{2}$	16	13 $\frac{1}{4}$	17 $\frac{1}{4}$
29	28 $\frac{1}{2}$	26 $\frac{1}{2}$	23 $\frac{1}{4}$	19 $\frac{3}{8}$	24 $\frac{1}{2}$	19 $\frac{1}{2}$	19 $\frac{1}{2}$	17 $\frac{3}{8}$	15 $\frac{3}{8}$	13	16 $\frac{3}{8}$
28 $\frac{1}{2}$	28	26	22 $\frac{3}{4}$	19	24 $\frac{3}{8}$	19	18 $\frac{3}{4}$	17 $\frac{1}{2}$	15 $\frac{1}{2}$	12 $\frac{1}{2}$	16 $\frac{1}{2}$
28	27 $\frac{1}{2}$	25 $\frac{3}{4}$	22 $\frac{3}{8}$	18 $\frac{3}{8}$	24	18 $\frac{1}{2}$	18 $\frac{1}{2}$	17	14 $\frac{3}{4}$	12 $\frac{3}{4}$	15 $\frac{3}{4}$
27 $\frac{1}{2}$	27	25 $\frac{1}{2}$	22	18 $\frac{1}{2}$	23 $\frac{1}{2}$	18	17 $\frac{3}{4}$	16 $\frac{3}{4}$	14 $\frac{3}{8}$	12	15 $\frac{1}{2}$
27	26 $\frac{1}{2}$	24 $\frac{3}{4}$	21 $\frac{1}{2}$	18	23 $\frac{1}{8}$	17 $\frac{1}{2}$	17 $\frac{1}{2}$	16	14	11 $\frac{1}{2}$	15
26 $\frac{1}{2}$	26	24 $\frac{1}{2}$	21 $\frac{1}{4}$	17 $\frac{3}{8}$	22 $\frac{3}{4}$	17	16 $\frac{3}{4}$	15 $\frac{1}{2}$	13 $\frac{3}{8}$	11 $\frac{1}{4}$	14 $\frac{1}{2}$
26	25 $\frac{1}{2}$	23 $\frac{3}{8}$	20 $\frac{3}{4}$	17 $\frac{1}{8}$	22 $\frac{1}{4}$	16 $\frac{1}{2}$	16 $\frac{1}{2}$	15 $\frac{1}{4}$	13 $\frac{1}{4}$	11	14 $\frac{1}{4}$
25 $\frac{1}{2}$	25	23 $\frac{1}{8}$	20 $\frac{1}{2}$	17	21 $\frac{1}{2}$	16	15 $\frac{3}{4}$	14 $\frac{3}{8}$	12 $\frac{3}{8}$	10 $\frac{3}{8}$	13 $\frac{3}{8}$
25	24 $\frac{1}{2}$	22 $\frac{1}{2}$	20	16 $\frac{1}{2}$	21 $\frac{1}{8}$	15 $\frac{1}{2}$	15 $\frac{1}{2}$	14 $\frac{1}{2}$	12 $\frac{1}{2}$	10 $\frac{1}{2}$	13 $\frac{1}{2}$
24 $\frac{1}{2}$	24	22 $\frac{1}{4}$	19 $\frac{3}{8}$	16 $\frac{1}{4}$	21	15	14 $\frac{3}{8}$	13 $\frac{3}{8}$	12	10	12 $\frac{3}{8}$
24	23 $\frac{1}{2}$	22	19 $\frac{1}{4}$	16	20 $\frac{1}{2}$	14 $\frac{1}{2}$	14 $\frac{1}{2}$	13 $\frac{1}{2}$	11 $\frac{3}{8}$	9 $\frac{3}{8}$	12 $\frac{1}{2}$
23 $\frac{1}{2}$	23 $\frac{1}{2}$	21 $\frac{1}{2}$	18 $\frac{3}{4}$	15 $\frac{3}{8}$	20 $\frac{1}{8}$	14	13 $\frac{3}{4}$	12 $\frac{3}{8}$	11 $\frac{1}{8}$	9 $\frac{1}{8}$	12
23	22 $\frac{3}{8}$	21 $\frac{1}{8}$	18 $\frac{1}{8}$	15 $\frac{1}{8}$	19 $\frac{3}{8}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	12 $\frac{1}{8}$	10 $\frac{3}{8}$	9	11 $\frac{1}{8}$
22 $\frac{1}{2}$	22 $\frac{1}{2}$	20 $\frac{1}{2}$	18	15	19 $\frac{1}{4}$	13	12 $\frac{3}{4}$	11 $\frac{3}{8}$	10 $\frac{1}{8}$	8 $\frac{3}{8}$	11 $\frac{1}{4}$
22	21 $\frac{1}{2}$	20 $\frac{1}{4}$	17 $\frac{1}{2}$	14 $\frac{1}{2}$	18 $\frac{1}{2}$	12 $\frac{1}{2}$	12 $\frac{1}{2}$	11 $\frac{1}{2}$	10	8 $\frac{1}{2}$	10 $\frac{1}{2}$

DIAMETERS OF YARDS AT THEIR QUARTERS.

Diameter at the Slinge.	Quarters.				Diameter at the Slinge.	Quarters.			
	$\frac{30}{31}$	$\frac{1}{2}$	$\frac{2}{10}$	$\frac{3}{4}$		$\frac{30}{31}$	$\frac{1}{2}$	$\frac{2}{10}$	$\frac{3}{4}$
	1st.	2nd.	3rd.	Arm.		1st.	2nd.	3rd.	Arm.
Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
22	21 $\frac{1}{2}$	19 $\frac{1}{2}$	15 $\frac{3}{4}$	9 $\frac{1}{16}$	12 $\frac{1}{2}$	12 $\frac{1}{16}$	10 $\frac{1}{2}$	8 $\frac{3}{4}$	5 $\frac{3}{8}$
21 $\frac{1}{2}$	20 $\frac{3}{4}$	18 $\frac{3}{8}$	15	9 $\frac{1}{4}$	12	11 $\frac{5}{8}$	10 $\frac{1}{2}$	8 $\frac{3}{8}$	5 $\frac{1}{2}$
21	20 $\frac{1}{2}$	18 $\frac{3}{8}$	14 $\frac{3}{4}$	9	11 $\frac{1}{2}$	11 $\frac{1}{16}$	10	8	4 $\frac{1}{2}$
20 $\frac{1}{2}$	19 $\frac{3}{8}$	17 $\frac{1}{2}$	14 $\frac{3}{8}$	8 $\frac{3}{4}$	11	10 $\frac{3}{8}$	9 $\frac{3}{8}$	7 $\frac{3}{4}$	4 $\frac{3}{4}$
20	19 $\frac{3}{8}$	17 $\frac{1}{2}$	14	8 $\frac{3}{16}$	10 $\frac{1}{2}$	10 $\frac{1}{16}$	9 $\frac{1}{2}$	7 $\frac{3}{8}$	4 $\frac{1}{2}$
19 $\frac{1}{2}$	18 $\frac{3}{8}$	17	13 $\frac{3}{8}$	8 $\frac{3}{4}$	10	9 $\frac{3}{8}$	8 $\frac{3}{4}$	7	4 $\frac{1}{4}$
19	18 $\frac{1}{2}$	16 $\frac{1}{2}$	13 $\frac{1}{4}$	8 $\frac{1}{2}$	9 $\frac{1}{2}$	9 $\frac{1}{8}$	8 $\frac{1}{4}$	6 $\frac{3}{8}$	4 $\frac{1}{16}$
18 $\frac{1}{2}$	17 $\frac{1}{2}$	16 $\frac{1}{2}$	13	8	9	8 $\frac{3}{4}$	7 $\frac{1}{2}$	6 $\frac{1}{2}$	3 $\frac{1}{2}$
18	17 $\frac{1}{2}$	15 $\frac{3}{4}$	12 $\frac{3}{4}$	7 $\frac{3}{4}$	8 $\frac{1}{2}$	8 $\frac{1}{4}$	7 $\frac{3}{8}$	5 $\frac{1}{2}$	3 $\frac{1}{8}$
17 $\frac{1}{2}$	17	15 $\frac{1}{2}$	12 $\frac{1}{2}$	7 $\frac{1}{2}$	8	7 $\frac{3}{4}$	7	5 $\frac{1}{2}$	3 $\frac{1}{2}$
17	16 $\frac{1}{2}$	14 $\frac{3}{8}$	11 $\frac{3}{8}$	7 $\frac{1}{4}$	7 $\frac{1}{2}$	7 $\frac{1}{4}$	6 $\frac{1}{2}$	5 $\frac{1}{4}$	3 $\frac{1}{4}$
16 $\frac{1}{2}$	16	14 $\frac{3}{8}$	11 $\frac{3}{8}$	7 $\frac{1}{16}$	7	6 $\frac{3}{4}$	6 $\frac{1}{8}$	4 $\frac{1}{2}$	3
16	15 $\frac{1}{2}$	14	11 $\frac{3}{16}$	6 $\frac{3}{8}$	6 $\frac{1}{2}$	6 $\frac{1}{4}$	5 $\frac{3}{4}$	4 $\frac{1}{2}$	2 $\frac{3}{4}$
15 $\frac{1}{2}$	15	13 $\frac{3}{16}$	10 $\frac{3}{8}$	6 $\frac{3}{8}$	6	5 $\frac{3}{8}$	5 $\frac{1}{4}$	4 $\frac{3}{16}$	2 $\frac{3}{16}$
15	14 $\frac{1}{2}$	13 $\frac{1}{8}$	10 $\frac{1}{2}$	6 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{3}{16}$	4 $\frac{3}{8}$	3 $\frac{3}{8}$	2 $\frac{3}{8}$
14 $\frac{1}{2}$	14	12 $\frac{3}{4}$	10 $\frac{1}{8}$	6 $\frac{1}{4}$	5	4 $\frac{3}{8}$	4 $\frac{3}{8}$	3 $\frac{1}{2}$	2 $\frac{1}{8}$
14	13 $\frac{1}{2}$	12 $\frac{1}{4}$	9 $\frac{3}{4}$	6	4 $\frac{1}{2}$	4 $\frac{3}{8}$	3 $\frac{1}{2}$	3 $\frac{1}{8}$	1 $\frac{1}{2}$
13 $\frac{1}{2}$	13	11 $\frac{3}{8}$	9 $\frac{1}{2}$	5 $\frac{3}{4}$	4	3 $\frac{3}{8}$	3 $\frac{1}{2}$	2 $\frac{1}{2}$	1 $\frac{3}{4}$
13	12 $\frac{1}{2}$	11 $\frac{1}{4}$	9 $\frac{1}{16}$	5 $\frac{3}{16}$	3 $\frac{1}{2}$	3 $\frac{3}{8}$	3 $\frac{1}{16}$	2 $\frac{7}{16}$	1 $\frac{1}{2}$

DIAMETERS OF DRIVER-BOOMS, JIB-BOOMS, ETC., AT THEIR
QUARTERS.

Driver-booms, Jib-booms, &c.					Driver-booms, Jib-booms, &c.				
Given Diameters.	Quarters.			Ends.	Given Diameters.	Quarters.			Ends.
	$\frac{20}{41}$	$\frac{11}{12}$	$\frac{8}{8}$			$\frac{20}{41}$	$\frac{11}{12}$	$\frac{8}{8}$	
	1st.	2nd.	3rd.			1st.	2nd.	3rd.	
Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
16	$15\frac{1}{2}$	$14\frac{1}{2}$	$13\frac{1}{2}$	$10\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{1}{2}$	$8\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{2}$
$15\frac{1}{2}$	$15\frac{1}{4}$	$14\frac{1}{4}$	13	$10\frac{1}{4}$	9	$8\frac{1}{4}$	$8\frac{1}{4}$	$7\frac{1}{4}$	6
15	$14\frac{1}{2}$	$13\frac{1}{2}$	$12\frac{1}{2}$	10	$8\frac{1}{2}$	$8\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{1}{8}$	$5\frac{1}{2}$
$14\frac{1}{2}$	$14\frac{1}{3}$	$13\frac{1}{3}$	12	$9\frac{1}{2}$	8	$7\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{2}$
14	$13\frac{1}{2}$	$12\frac{1}{2}$	$11\frac{1}{2}$	$9\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	5
$13\frac{1}{2}$	$13\frac{1}{2}$	$12\frac{1}{2}$	$11\frac{1}{2}$	9	7	$6\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$
13	$12\frac{1}{2}$	$11\frac{1}{2}$	$10\frac{1}{2}$	$8\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	6	$5\frac{1}{4}$	$4\frac{1}{2}$
$12\frac{1}{2}$	$12\frac{1}{2}$	$11\frac{1}{2}$	$10\frac{1}{4}$	$8\frac{1}{2}$	6	$5\frac{1}{2}$	$5\frac{1}{2}$	5	4
12	$11\frac{1}{2}$	11	10	8	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{4}$	$4\frac{1}{2}$	$3\frac{1}{2}$
$11\frac{1}{2}$	$11\frac{1}{2}$	$10\frac{1}{2}$	$9\frac{1}{2}$	$7\frac{1}{2}$	5	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{2}$
11	$10\frac{1}{2}$	$10\frac{1}{4}$	$9\frac{1}{2}$	$7\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{2}$	3
$10\frac{1}{2}$	$10\frac{1}{2}$	$9\frac{1}{2}$	$8\frac{1}{2}$	7	4	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{1}{2}$
10	$9\frac{1}{2}$	$9\frac{1}{2}$	$8\frac{1}{2}$	$6\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{2}$

DIAMETERS OF MAIN-BOOMS AND GAFFS, AT THEIR
QUARTERS.

Main-booms.							Gaffs.				
Given Diameter.	Quarters.			Fore-end.	Middle.	After-end.	Given Diameter.	Quarters.			End.
	$\frac{4}{1}$	$\frac{1}{3}$	$\frac{2}{3}$					$\frac{4}{1}$	$\frac{1}{3}$	$\frac{2}{3}$	
	1st.	2nd.	3rd.					1st.	2nd.	3rd.	
Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
16	15 $\frac{1}{2}$	14 $\frac{1}{2}$	14	10 $\frac{1}{2}$	14 $\frac{1}{2}$	12	12	11 $\frac{1}{2}$	11	9 $\frac{1}{2}$	6 $\frac{1}{2}$
15 $\frac{1}{2}$	15 $\frac{1}{4}$	14 $\frac{1}{4}$	13 $\frac{1}{2}$	10 $\frac{1}{4}$	14 $\frac{1}{4}$	11 $\frac{1}{2}$	11 $\frac{1}{2}$	11 $\frac{1}{4}$	10 $\frac{1}{2}$	9 $\frac{1}{4}$	6 $\frac{3}{4}$
15	14 $\frac{3}{4}$	13 $\frac{3}{4}$	13 $\frac{1}{4}$	10	13 $\frac{3}{4}$	11 $\frac{1}{4}$	11	10 $\frac{3}{4}$	10 $\frac{1}{4}$	8 $\frac{3}{4}$	6 $\frac{1}{4}$
14 $\frac{1}{2}$	14 $\frac{1}{8}$	13 $\frac{3}{8}$	12 $\frac{3}{8}$	9 $\frac{3}{8}$	13 $\frac{1}{8}$	10 $\frac{3}{8}$	10 $\frac{1}{2}$	10 $\frac{1}{8}$	9 $\frac{3}{8}$	8 $\frac{3}{8}$	5 $\frac{3}{8}$
14	13 $\frac{1}{2}$	13	12 $\frac{1}{2}$	9 $\frac{1}{2}$	12 $\frac{1}{2}$	10 $\frac{1}{2}$	10	9 $\frac{1}{2}$	9 $\frac{1}{2}$	8	5 $\frac{1}{2}$
13 $\frac{1}{2}$	13 $\frac{1}{4}$	12 $\frac{1}{4}$	11 $\frac{1}{4}$	9	12 $\frac{1}{4}$	10 $\frac{1}{4}$	9 $\frac{1}{2}$	9 $\frac{1}{4}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$	5 $\frac{1}{4}$
13	12 $\frac{3}{4}$	12	11 $\frac{3}{4}$	8 $\frac{3}{4}$	11 $\frac{3}{4}$	9 $\frac{3}{4}$	9	8 $\frac{3}{4}$	8 $\frac{1}{4}$	7 $\frac{1}{4}$	5
12 $\frac{1}{2}$	12 $\frac{1}{2}$	11 $\frac{1}{2}$	10 $\frac{1}{2}$	8 $\frac{1}{2}$	11 $\frac{1}{2}$	9 $\frac{1}{2}$	8 $\frac{1}{2}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$	6 $\frac{1}{2}$	4 $\frac{1}{2}$
12	11 $\frac{3}{4}$	11 $\frac{1}{4}$	10 $\frac{3}{4}$	8	11	9	8	7 $\frac{3}{4}$	7 $\frac{1}{4}$	6 $\frac{3}{4}$	4 $\frac{3}{4}$
11 $\frac{1}{2}$	11 $\frac{1}{2}$	10 $\frac{1}{2}$	10	7 $\frac{1}{2}$	10 $\frac{1}{2}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$	7 $\frac{1}{2}$	6 $\frac{1}{2}$	6	4 $\frac{1}{2}$
11	10 $\frac{3}{4}$	10 $\frac{1}{4}$	9 $\frac{3}{4}$	7 $\frac{3}{4}$	10 $\frac{1}{4}$	8 $\frac{1}{4}$	7	6 $\frac{3}{4}$	6 $\frac{1}{4}$	5 $\frac{3}{4}$	3 $\frac{3}{4}$
10 $\frac{1}{2}$	10 $\frac{1}{2}$	9 $\frac{1}{2}$	9 $\frac{1}{2}$	7	9 $\frac{1}{2}$	7 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	6	5 $\frac{1}{2}$	3 $\frac{1}{2}$
10	9 $\frac{3}{4}$	9 $\frac{1}{4}$	8 $\frac{3}{4}$	6 $\frac{3}{4}$	9 $\frac{1}{4}$	7 $\frac{1}{4}$	6	5 $\frac{3}{4}$	5 $\frac{1}{4}$	4 $\frac{3}{4}$	3 $\frac{1}{4}$
9 $\frac{1}{2}$	9 $\frac{1}{2}$	8 $\frac{1}{2}$	8 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$					
9	8 $\frac{3}{4}$	8 $\frac{1}{4}$	7 $\frac{3}{4}$	6	8 $\frac{1}{4}$	6 $\frac{3}{4}$					
8 $\frac{1}{2}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$	7 $\frac{1}{2}$	5 $\frac{1}{2}$	7 $\frac{1}{2}$	6 $\frac{1}{2}$					
8	7 $\frac{3}{4}$	7 $\frac{1}{4}$	7	5 $\frac{3}{4}$	7 $\frac{1}{4}$	6					

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Ship 1563 tons.								Ship 1415 tons.								Ship 1330 tons.							
	Dimensions of Ship: Length, 212 ft. 6 in.; Breadth, 42 ft. 6 in.								Dimensions of Ship: Length, 190 ft.; Breadth, 41 ft.								Dimensions of Ship: Length, 176 ft.; Breadth, 40 ft.							
	Masts or Booms.				Yards.				Masts or Booms.				Yards.				Masts or Booms.				Yards.			
	Extreme Length.	Headed Length.	Diameter.	Arm.	Extreme Length.	Headed Length.	Diameter.	Arm.	Extreme Length.	Headed Length.	Diameter.	Arm.	Extreme Length.	Headed Length.	Diameter.	Arm.	Extreme Length.	Headed Length.	Diameter.	Arm.	Extreme Length.	Headed Length.	Diameter.	Arm.
Main-mast and yard.	101 0	16 0	32	4 9	89 6	15 6	30	4 0	96 0	15 6	30	4 0	84 0	15 0	22	4 0	93 0	15 0	30	4 3	82 6	15 0	20 1/2	4 3
Top-mast and yard.	60 0	19 0	19	5 3	70 0	8 6	16	5 0	58 0	8 6	19	5 0	66 0	8 0	16	5 0	53 3	8 3	17	6 4	64 0	8 0	15	6 4
Toppallant-mast and yard.	24 0	..	14	3 0	30 0	11 1/2	8 1/2	2 6	32 0	..	13	4 6	2 6	11	8 1/2	2 6	29 0	..	10	4 5	28 0	10	10	4 5
Royal-mast and yard.	22 6	..	8 1/2	3 3	22 6	..	8 1/2	3 3	21 0	..	8 1/2	3 3	21 0	..	8 1/2	3 3	20 9	..	6 1/2	3 4	24 6	4 0	7 1/2	3 4
Fore-mast and yard.	94 0	15 0	32	4 9	82 6	15 0	30	4 0	91 0	15 0	30	4 0	76 0	14 0	21 1/2	4 0	80 0	14 0	29 1/2	4 0	73 0	4 0	17 1/2	4 0
Top-mast and yard.	56 0	8 0	18 1/2	5 0	66 0	8 0	18 1/2	5 0	53 0	8 0	13 1/2	5 0	62 0	8 0	15 1/2	5 0	51 0	8 0	16 1/2	5 0	58 0	8 0	12 1/2	5 0
Toppallant-mast and yard.	27 6	..	12 1/2	2 9	46 0	..	11 1/2	2 6	28 0	..	13	2 6	42 0	2 6	11 1/2	2 6	26 6	..	9	4 1	46 2	2 6	9 1/2	4 1
Royal-mast and yard.	21 0	..	8	3 5	36 0	..	8 1/2	3 0	19 6	..	8	3 0	36 0	..	8	3 0	18 9	..	7	3 0	30 3	1 6	6	3 0
Mizen-mast and cross-jack yard.	80 0	10 10	23 1/2	6 0	72 0	8 0	15	6 0	85 0	11 9	20	6 0	68 0	10 4	14 1/2	6 0	69 0	10 4	19	6 8	69 0	6 0	13 1/2	6 0
Top-mast and yard.	45 6	0 9	15	4 2	65 0	4 2	13	4 2	42 0	6 6	14 1/2	4 2	50 0	6 4	12 1/2	4 0	40 9	6 4	12 1/2	46 9	3 3	10	7 3	3 3
Toppallant-mast and yard.	24 0	..	9	4 3	30 0	2 6	10	2 6	22 0	..	10	3 0	38 0	2 0	9 1/2	2 0	21 0	..	7	3 4	3 3	1 10	7 3	1 10
Royal-mast and yard.	19 6	..	7	3 4	20 0	6 1/2	6 1/2	2 0	16 0	..	6 1/2	2 0	28 0	1 6	5 1/2	1 6	15 0	..	5	2 6	0	1 4	5 1/2	1 4
Bowsprit	61 0	..	31	..	..	..	..	..	56 0	End.	30	..	..	..	..	..	54 6	..	29	..	..	..	..	..
Lib-boom	50 0	..	15	..	..	..	..	..	48 0	2 6	14 1/2	..	..	..	..	..	48 0	..	14 1/2	..	..	..	..	..
Flying-jib-boom	50 0	..	11	..	..	..	..	..	52 0	1 0	10 1/2	..	..	..	..	..	61 0	..	10 1/2	..	..	..	..	..
Driver-boom . . . . .	..	..	..	..	..	..	..	..	64 0	1 0	13 1/2	..	..	..	..	..	60 0	..	13	..	..	..	..	..
Gaff	44 0	3 0	11 1/2	..	..	..	..	..	47 0	6 0	11	..	..	..	..	..	45 6	..	11	..	..	..	..	..

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Ship 1200 tons.										Ship 1400 tons.										Ship 1600 tons.									
	Masts or Booms.					Yards.					Masts or Booms.					Yards.					Masts or Booms.					Yards.				
	Extremes Length.	Headed Length.	Diameter.	Extremes Length.	Arm.	Extremes Length.	Arm.	Diameter.	Extremes Length.	Arm.	Extremes Length.	Headed Length.	Diameter.	Extremes Length.	Arm.	Extremes Length.	Headed Length.	Diameter.	Extremes Length.	Arm.	Extremes Length.	Headed Length.	Diameter.	Extremes Length.	Arm.	Extremes Length.	Headed Length.	Diameter.	Extremes Length.	Arm.
Main-mast and yard	80 6	14 6	29 1/2	79 6	4 3	19	19	19	19	19	86 0	13 10	27 1/2	76 0	4 3	18	18	18	18	18	83 0	13 0	26 1/2	74 0	4 0	17 1/2	74 0	4 0	17 1/2	74 0
Top-mast and yard	53 6	8 0	16 1/2	62 0	4 9	14	14	14	14	14	51 6	8 0	16 1/2	60 0	4 9	14	14	14	14	14	50 0	7 6	16 1/2	59 0	4 9	18 1/2	59 0	4 9	18 1/2	59 0
Topgallant-mast and yard	28 3	..	10	44 0	3 6	9	9	9	9	9	27 6	..	10	42 6	2 6	9	9	9	9	9	23 6	..	7	41 6	2 6	9	41 6	2 6	9	41 6
Royal-mast and yard	19 9	..	7	33 6	1 6	7	7	7	7	7	19 0	..	7	32 0	1 6	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	20 6	..	7	30 6	1 9	6 1/2	30 6	1 9	6 1/2	30 6
Fore-mast and yard	83 0	13 6	27	70 6	4 0	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	80 6	13 0	26 1/2	68 0	4 0	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	78 0	12 6	26 1/2	66 0	4 0	16 1/2	66 0	4 0	16 1/2	66 0
Top-mast and yard	49 3	7 9	12 1/2	56 6	4 6	12	12	12	12	12	47 6	7 6	15 1/2	55 0	4 6	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	46 0	7 0	13 1/2	54 0	4 6	11 1/2	54 0	4 6	11 1/2	54 0
Topgallant-mast and yard	25 0	..	9	40 0	2 4	8	8	8	8	8	25 0	..	9	38 6	2 4	8	8	8	8	8	25 6	..	4	38 0	2 6	8	38 0	2 6	8	38 0
Royal-mast and yard	18 0	..	6	29 3	1 6	6	6	6	6	6	17 6	..	6	28 0	1 6	6	6	6	6	6	17 6	..	4	27 0	1 6	6	27 0	1 6	6	27 0
Mizen-mast and yard	65 6	10 6	19	62 0	6 0	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	63 0	10 6	18 6	60 9	6 0	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	60 0	10 6	17 6	60 0	6 0	13 1/2	60 0	6 0	13 1/2	60 0
Top-mast and yard	39 3	6 0	12	45 4	3 0	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	38 6	6 0	12 4	44 0	3 0	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	38 0	6 0	12 4	43 0	3 0	9 1/2	43 0	3 0	9 1/2	43 0
Topgallant-mast and yard	20 6	..	7	33 0	1 9	7	7	7	7	7	20 0	..	7	31 6	1 9	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	20 0	..	7	30 6	2 0	6 1/2	30 6	2 0	6 1/2	30 6
Royal-mast and yard	14 6	..	5	24 9	1 3	5	5	5	5	5	14 0	..	5	23 6	1 6	5	5	5	5	5	14 0	..	5	23 6	1 6	5	23 6	1 6	5	23 6
Bowprit	33 0	..	..	..	..	..	..	..	..	..	52 6	End.	..	..	..	..	..	..	..	..	52 0	End.	..	..	..	..	..	..	..	..
Jib-boom	46 0	2 0	..	..	..	..	..	..	..	..	46 0	2 0	..	..	..	..	..	..	..	..	42 6	2 0	13 1/2	..	..	..	..	..	..	..
Flying-jib-boom	50 0	1 0	..	..	..	..	..	..	..	..	49 6	1 0	..	..	..	..	..	..	..	..	45 0	1 0	9	..	..	..	..	..	..	..
Driver-boom	53 0	1 0	..	..	..	..	..	..	..	..	52 0	1 0	..	..	..	..	..	..	..	..	50 0	1 0	8 1/2	..	..	..	..	..	..	..
Gaff	43 6	5 9	..	..	..	..	..	..	..	..	42 0	5 6	..	..	..	..	..	..	..	..	40 0	4 6	10 1/2	..	..	..	..	..	..	..

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Ship of 400 tons.						Ship of 800 tons.						Ship of 1200 tons.					
	Dimensions of Ship: Length, 110 ft.; Breadth, 38 ft.						Dimensions of Ship: Length, 152 ft.; Breadth, 54 ft. 6 in.						Dimensions of Ship: Length, 129 ft. 6 in.; Breadth, 32 ft. 9 in.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Length.	Healed.	Diameter.	Extreme Length.	Arm.	Diameter.		Length.	Healed.	Diameter.	Arm.	Diameter.		Length.	Healed.	Diameter.	Arm.	Diameter.
Main-mast and yard	82 0	13 0	26½	73 6	4 0	20	80 0	18 0	26	72 0	4 0	16	63 0	12 6	22½	63 0	4 0	14½
Top-mast and yard	49 6	7 8	16	53 0	4 6	14	48 0	7 6	15½	55 0	4 6	13½	47 0	6 9	14½	50 0	4 0	11
Topgallant-mast and yard	25 9	..	7	43 0	2 8	9½	24 0	..	8½	39 0	2 6	8½	26 0	..	7	38 6	2 6	8
Royal-mast and yard	17 6	..	6	30 0	1 8	6	16 6	..	6½	27 6	1 9	6½	20 0	..	6½	25 0	1 8	5
Fore-mast and yard	77 0	13 0	26	65 6	3 9	16½	75 0	12 6	25½	64 0	3 9	15½	71 0	11 6	22½	68 0	3 6	19½
Top-mast and yard	45 6	7 2	15½	52 6	4 8	12	44 0	7 0	15	49 6	4 3	12	43 6	6 0	14	40 0	3 9	10½
Topgallant-mast and yard	23 6	..	5½	37 6	2 6	7½	22 0	..	8½	35 0	2 3	8½	24 0	..	7	36 0	2 8	8
Royal-mast and yard	16 0	..	5	26 0	1 6	5½	15 0	..	6½	24 6	1 9	6½	19 0	..	6½	23 0	1 2	5
Mizen-mast and yard	59 0	10 0	20	59 0	6 0	18	57 6	9 6	17	56 0	6 0	11	63 0	9 0	15	60 0	4 6	10½
Top-mast and yard	37 0	5 8	12	42 0	3 6	9	36 6	5 9	11½	38 0	3 0	8½	36 0	5 3	10	37 0	3 0	9
Topgallant-mast and yard	19 6	..	6½	30 0	2 0	6½	18 3	..	6½	27 0	1 6	6	20 0	..	6½	27 0	2 0	6
Royal-mast and yard	13 0	..	4½	21 6	1 6	4½	12 0	..	5½	19 0	1 0	5	16 0	..	5½	21 0	1 3	4½
Bowprit	50 0	..	26½	..	..	..	48 0	End.	25	..	..	..	47 0	..	23	..	..	..
Jib-boom	45 0	2 0	14	..	..	..	44 0	2 0	11½	..	..	..	40 0	1 6	11	..	..	..
Flying jib-boom.	49 0	..	9	..	..	..	48 0	..	8½	..	..	..	41 0	..	7½	..	..	..
Driver-boom or out-rigger	..	..	..	..	..	..	..	..	..	..	..	..	16 0	..	..	..	..	..
Gaff	41 6	6 0	9	..	..	..	40 0	6 0	8½	..	..	..	38 6	4 6	8½	..	..	..

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Barque of 410 tons.						Barque of 400 tons.						Barque of 480 tons.					
	Dimensions of Ship: Length, 104 ft.; Breadth, 27 ft. 9 in.						Dimensions of Ship: Length, 101 ft. 6 in.; Breadth, 28 ft. 6 in.						Dimensions of Ship: Length, 117 ft.; Breadth, 29 ft.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast and yard	Ft. In. 66 0	9 6	21	55 0	3 0	13½	Ft. In. 68 0	10 9	21	54 0	3 6	14	Ft. In. 71 0	10 0	21½	57 0	3 8	13½
Top-mast and yard	36 0	5 3	13½	44 0	3 6	11	38 0	6 0	12½	41 6	3 9	10½	39 0	6 3	12½	45 0	3 0	11
Topgallant-mast and yard	19 0	..	8	31 0	2 0	7½	18 6	Pole.	7½	25 0	2 6	7	20 0	..	7½	34 0	2 6	8
Royal-mast and yard	12 0	..	4½	21 0	1 6	5	11 6	6 0	4½	19 0	1 6	5½	11 0	..	4	25 0	2 0	5½
Fore-mast and yard	62 0	9 0	20½	53 0	3 0	13	65 0	10 6	20½	51 0	3 6	12½	63 6	10 0	20½	57 0	3 8	13½
Top-mast and yard	36 0	5 3	13½	42 0	3 6	11	36 6	5 6	12	39 0	3 6	10	39 0	6 3	12½	45 0	3 0	11
Topgallant-mast and yard	18 0	..	8	29 6	1 9	7	17 6	..	7½	26 6	2 6	7	20 0	..	7½	34 0	2 6	8
Royal-mast and yard	11 0	..	4½	20 0	1 3	4½	10 6	5 6	4½	17 6	1 6	5½	11 0	..	4	25 0	2 0	5½
Mizen-mast	63 0	7 9	17	..	..	..	62 0	9 0	14	..	..	..	64 6	9 0	17½	..	..	..
Top-mast	31 0	..	8½	..	..	..	40 6	..	8	..	..	..	35 0	11 0	9½	..	..	..
Pole	12 0	..	5½	..	..	..	9 0	5 6	6	..	..	..	4 0	..	..	..	..	..
Bowsprit	36 0	..	22	..	..	..	42 0	..	22	..	..	..	38 0	..	21	..	..	..
Jib-boom	33 0	1 0	11½	..	..	..	38 0	..	10½	..	..	..	35 0	..	11½	..	..	..
Flying-jibboom	39 0	1 6	8	..	..	..	40 0	..	7	..	..	..	39 0	..	8	..	..	..
Mizen-boom	34 0	..	8	..	..	..	35 0	..	8½	..	..	..	39 0	..	9	..	..	..
Gaff	30 0	5 0	7½	..	..	..	29 0	4 0	8	..	..	..	36 0	..	8	..	..	..
Main-gaff	21 0	0 6	8½	..	..	..	22 0	..	8½	..	..	..	21 0	..	8½	..	..	..

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Barque of 350 tons.						Barque of 320 tons.						Barque of 300 tons.					
	Dimensions of Ship: Length, 101 ft.; Breadth, 27 ft. 9 in.						Dimensions of Ship: Length, 100 ft. 6 in.; Breadth, 27 ft. 6 in.						Dimensions of Ship: Length, 100 ft.; Breadth, 27 ft. 8 in.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Healed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Healed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Healed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast and yard	64 6	9 6	20 1/2	53 0	3 3	13 1/2	63 0	9 6	19	51 6	3 0	12 1/2	62 0	9 0	18 1/2	50 0	3 0	12
Top-mast and yard	35 0	5 0	12 1/2	42 0	3 6	10 1/2	34 0	5 0	12	41 6	3 0	10	34 0	5 0	12	40 0	3 0	9 1/2
Torgallant-mast and yard	18 0	..	7 1/2	31 6	2 0	7 1/2	18 0	..	7	31 6	2 0	7	17 6	..	7	30 0	2 0	6 1/2
Royal-mast and yard	12 0	..	4 1/2	22 0	1 6	5	12 0	..	..	22 0	1 6	4 1/2	12 0	6 0	..	21 0	1 0	4 1/2
Fore-mast and yard	61 6	9 3	20	51 0	3 3	12 1/2	61 0	9 3	18 1/2	51 0	3 0	12 1/2	60 0	9 0	18 1/2	50 0	3 0	12
Top-mast and yard	34 0	5 0	12 1/2	41 6	3 6	10 1/2	34 0	5 0	12	41 6	3 0	10	34 0	5 0	12	40 0	3 0	9 1/2
Torgallant-mast and yard	17 0	..	7 1/2	29 6	2 0	7	18 0	..	7	31 6	2 0	7	17 6	..	7	30 0	2 0	6 1/2
Royal-mast and yard	11 6	..	4 1/2	20 0	1 3	4 1/2	12 0	..	..	22 0	1 6	4 1/2	12 0	0 0	..	21 0	1 6	4 1/2
Mizen-mast	61 0	8 9	14	..	..	..	60 0	8 0	13	..	..	..	60 0	8 0	13	..	..	..
Top-mast	39 6	..	8	..	..	..	48 0	..	8 1/2	..	..	..	47 0	..	8	..	..	..
Pole	9 0	..	..	..	..	..	9 0	..	..	..	..	..	10 0	7 0	..	..	..	..
Bowsprit	37 0	..	22	..	..	..	35 0	..	10	..	..	..	34 0	..	19	..	..	..
Jib-boom	35 0	..	11	..	..	..	34 0	..	10 1/2	..	..	..	34 0	..	10 1/2	..	..	..
Flying-jibboom	39 0	..	..	..	..	..	38 0	..	6 1/2	..	..	..	38 0	..	6 1/2	..	..	..
Mizen-boom	37 0	..	8	..	..	..	37 0	..	8	..	..	..	36 0	..	8	..	..	..
Oak	31 0	5 0	8	..	..	..	29 0	4 0	7 1/2	..	..	..	30 0	5 0	7 1/2	..	..	..
Main-gaff	21 0	..	5 1/2	..	..	..	19 0	..	8	..	..	..	18 0	..	8	..	..	..

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Brig 6, 382 tons.						Barque of 150 tons.						Brig of 260 tons.					
	Dimensions of Ship: Length 106 ft. 3 in.; Breadth, 27 ft. 6 in.						Dimensions of Ship: Length, 90 ft.; Breadth, 22 ft.						Dimensions of Ship: Length, 92 ft.; Breadth, 25 ft.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast and yard	71 0	11 0	21½	55 0	3 0	14	54 0	8 0	16	10	2 6	10	60 0	9 0	18	50 0	3 0	11½
Top-mast and yard	40 0	6 6	12½	42 6	3 9	11	32 0	4 6	10	31 0	2 0	7½	34 0	5 0	11½	40 0	3 6	9½
Torgallant-mast and yard	19 6	..	7½	28 0	2 0	7	16 0	1 6	6½	20 0	1 6	4½	17 0	..	7	30 0	2 0	6½
Royal-mast and yard	13 0	..	..	20 0	1 4	5	..	..	..	..	..	..	10 0	Pole.	4½	21 0	1 6	4½
Fore-mast and yard	66 0	11 0	21	51 6	3 0	13	51 0	8 0	16	42 0	..	..	28 0	9 0	18	50 0	3 6	11½
Top-mast and yard	38 0	6 0	12	39 0	3 6	10½	32 0	4 6	10	31 0	2 0	7½	34 0	5 0	11½	40 0	3 6	9½
Torgallant-mast and yard	18 6	..	7½	26 6	2 0	7	16 0	1 6	6½	20 0	1 6	4½	17 0	..	7	30 0	2 0	6½
Royal-mast and yard	12 0	..	..	13 0	1 3	5	..	..	..	..	..	..	10 0	Pole.	4½	21 0	1 6	4½
Mizen-mast	..	..	..	..	..	..	52 0	6 0	11	..	..	..	..	..	..	..	..	..
Top-mast	..	..	..	..	..	..	40 0	..	7	..	..	..	..	..	..	..	..	..
Pole	..	..	..	..	..	..	10 0	..	16½	..	..	..	..	..	..	..	..	..
Bowsprit	42 0	..	22	..	..	..	32 0	..	9	..	..	..	33 0	..	18	..	..	..
Jib-boom	38 0	..	11	..	..	..	33 0	..	6	..	..	..	34 0	..	10	..	..	..
Flying-jibboom	83 0	..	7	..	..	..	35 6	..	..	..	..	..	37 0	..	6½	..	..	..
Mizen-boom or Main-boom	43 0	..	13	..	..	..	28 0	..	..	..	..	..	50 0	..	11	..	..	..
Gaff	..	..	..	..	..	..	25 0	3 0	6½	..	..	..	..	..	..	..	..	..
Main-gaff	34 0	4 0	8½	..	..	..	..	..	..	..	..	..	26 0	4 0	6½	..	..	..
Trysail-mast	..	..	..	..	..	..	..	..	..	..	..	..	27 0	..	..	..	..	..

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Brig of 220 tons.						Brig of 220 tons.						Brig of 220 tons.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast and yard	62 0	9 4	18	47 0	3 6	11	54 0	8 0	16	38 0	2 0	9	56 0	8 0	17 1/2	40 0	2 9	10
Top-mast and yard	34 0	5 4	11	38 0	3 0	9	30 0	4 6	9 1/2	30 0	1 6	7	31 0	4 6	10	32 0	2 0	8
Topgallant-mast and yard	18 0	..	6	29 0	2 6	6 1/2	15 0	..	6	22 0	1 0	5	15 0	..	6	24 0	1 6	6
Royal-mast and yard	12 0	..	4 1/2	21 0	1 6	4 1/2	10 0	..	4	..	..	..	10 0	..	4	18 0	1 0	4
Fore-mast and yard	60 0	9 0	17 1/2	47 0	3 6	11	52 0	8 0	15 1/2	38 0	2 0	9	54 0	8 0	16	40 0	2 9	10
Top-mast and yard	34 0	5 4	11	38 0	3 0	9	30 0	4 6	9 1/2	30 0	1 6	7	31 0	4 6	10	32 0	2 0	8
Topgallant-mast and yard	18 0	..	6	29 0	2 6	6 1/2	15 0	..	6	22 0	1 0	5	15 0	..	6	26 0	1 6	6
Royal-mast and yard	12 0	..	4 1/2	21 0	1 6	4 1/2	10 0	..	4	..	..	..	10 0	..	4	18 0	1 0	4
Fore-mast	35 0	..	18	..	..	..	34 0	..	17	..	..	..	34 0	..	17	..	..	..
Fore-boom	33 0	..	8 1/2	..	..	..	32 0	..	8 1/2	..	..	..	32 0	..	8 1/2	..	..	..
Main-boom	44 0	..	12	..	..	..	37 0	..	10	..	..	..	36 0	..	10	..	..	..
Gaff	36 0	..	9	..	..	..	29 0	..	7 1/2	..	..	..	28 0	..	7 1/2	..	..	..
Housing of Fore-mast	16 6	..	..	..	..	..	12 3	..	..	..	..	..	13 6	..	..	..	..	..
" Main-mast	16 6	..	..	..	..	..	12 3	..	..	..	..	..	13 0	..	..	..	..	..

DIMENSIONS OF MASTS AND YARDS IN THE MERCHANT SERVICE.

NAMES OF THE MASTS AND YARDS.	Brig of 160 tons.						Brig of 10 Ycls.						Brigantine.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast and yard	Ft. In. 48 0	Ft. In. 7 0	In. 14 1/2	Ft. In. 39 0	Ft. In. 3 0	In. 10	Ft. In. 48 0	Ft. In. 8 0	In. 14 1/2	Ft. In. 37 0	Ft. In. 2 0	In. 9 1/2	Ft. In. 53 0	Ft. In. 6 6	In. 13	Ft. In. 40 0	Ft. In. 2 6	In. 10
Top-mast and yard	28 0	4 0	9	31 0	3 0	8	26 6	4 6	8 1/2	29 0	2 8	7 1/2	34 0	..	7 1/2	..	..	..
Topgallant-mast and yard	14 0	..	4 1/2	24 0	1 6	6	13 6	..	4 1/2	21 0	1 9	5	..	..	..	..	..	..
Royal-mast and yard	9 6	..	4	18 0	1 0	4	8 6	5 0	4	15 0	1 3	4	..	..	..	..	..	..
Fore-mast and yard	46 0	7 0	14 1/2	39 0	3 0	10	46 0	8 0	14 1/2	37 0	2 9	9 1/2	49 0	6 0	15	40 0	2 6	10
Top-mast and yard	28 0	4 0	9	31 0	3 0	8	26 6	4 6	8 1/2	29 0	2 8	7 1/2	34 0	3 0	8	31 0	2 0	8
Topgallant-mast and yard	14 0	..	4 1/2	24 0	1 6	6	13 6	..	4 1/2	21 0	1 9	5	11 0	..	4	22 0	1 6	5 1/2
Royal-mast and yard	9 6	..	4	18 0	1 0	4	8 6	5 0	4	15 0	1 3	4	7 0	..	3 1/2	16 6	1 0	4
Bowsprit	28 0	..	14	..	..	..	29 0	..	14 1/2	..	..	..	26 0	..	13 1/2	..	..	..
Jib-boom	26 0	..	6 1/2	..	..	..	27 0	..	7	..	..	..	26 0	..	6 1/2	..	..	..
Main-boom	38 0	..	9 1/2	..	..	..	34 0	..	8 1/2	..	..	..	37 6	End.	9 1/2	..	..	..
Gaff	27 0	..	7 1/2	..	..	..	28 0	..	7 1/2	..	..	..	30 0	4 0	8	..	..	..
Fore-boom	..	..	..	..	..	..	..	..	..	..	..	..	22 0	..	6	..	..	..
Gaff	..	..	..	..	..	..	..	..	..	..	..	..	20 0	..	5 1/2	..	..	..
Housing of Masts	12 0	..	..	..	..	..	11 0	..	..	..	..	..	10 3	..	..	..	..	..

DIMENSIONS OF MASTS, YARDS, ETC., OF A FAST-SAILING
CLIPPER SCHOONER.

	Ft. In.		Ft. In.		In.
Main-mast from deck to top of cheeks	47 10	Head	8 3	Diameter	15½
Fore-mast do. do.	45 0	"	7 10	"	15
Fore-top-mast, hoist	21 0*	"	"	"	7
Fore-topgallant-mast	12 0	Royal	8 6	"	5
Main-top-mast, hoist	25 0	Polo	6 0	"	7½
Bowsprit outside	20 0	"	"	"	15
Jib-boom outside of cap	16 0	"	"	"	6
Flying jibboom	10 6	"	"	"	3½
Fore-yard	55 0	Arm	2 10	"	13
Fore-topsail-yard	41 0	"	2 3	"	10
Fore-topgallant-yard	29 6	"	1 6	"	7
Main-boom	59 0	"	"	"	13
Gaff for sail	29 0	Polo	4 0	"	7
Fore-gaff	23 3	"	"	"	6
Gaff-topsail-yard for sail	7 0	"	"	"	3
Lower-masts, house each	13 6	"	"	"	"
Distance from fore-stay to centre of fore-mast	29 6	"	"	"	"
Distance from centre of fore-mast to main-mast	24 0	"	"	"	"
Distance from centre of main-mast to taffrail	46 6	"	"	"	"
Breadth of rigging to rigging at fore-mast	21 0	"	"	"	"
Breadth of rigging to rigging at main-mast	21 0	"	"	"	"
Height of rail	3 6	"	"	"	"
Rise of deck	1 0	"	"	"	"
Rake of the fore-mast to the foot	0 1½	"	"	"	"
Rake of the main-mast to the foot	0 2	"	"	"	"
Steave of bowsprit to the foot	0 8½	"	"	"	"

DIMENSIONS OF MASTS AND YARDS OF SCHOONERS.

NAMES OF THE MASTS AND YARDS.	Schooner of 143 tons.						Schooner of 91 tons.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Headed Length.	Arm.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast	58 0	7 0	13	..	..	..	54 0	8 0	12½	..	..	..
Top-mast and pole	33 0	8 0	12	..	..	..	28 0	6 0	7½	..	..	..
Fore-mast and yard	57 0	7 0	13	41 0	2 0	2 0	46 0	7 2	12	36 0	1 6	7½
Top-mast and yard	18 0	..	14	32 0	1 10	1 10	24 0	4 0	7	28 0	1 4	6
Totgallant-mast and yard	11 0	..	..	22 0	1 6	1 6	12 0	..	4½	18 0	1 0	4½
Bowsprit	27 0	..	12½	..	..	..	27 0	..	12	..	..	..
Jib-boom	32 0	..	12	..	..	..	25 0	..	7	..	..	..
Pole	6 0	..	..	..	..	..	..	..	..	..	..	..
Main-boom	40 0	..	10	..	..	..	36 0	..	9	..	..	..
Gaff	28 0	..	14	..	..	..	28 0	..	7½	..	..	..
Fore-boom	24 0	..	6½	..	..	..	24 0	..	6½	..	..	..
Gaff	21 0	..	6	..	..	..	22 0	..	6½	..	..	..

DIMENSIONS OF MASTS AND YARDS OF SCHOONERS.

NAMES OF THE MASTS AND YARDS.	Schooner of 137 tons.						Schooner of 166 tons.						Schooner of 168 tons.					
	Dimensions of Vessel: Length, 81 ft.; Breadth, 22 ft.						Dimensions of Vessel: Length, 78 ft.; Breadth, 21 ft.						Dimensions of Vessel: Length, 75 ft.; Breadth, 21 ft.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Arm.	Length.	Diameter.
Main-mast	64 6	9 0	15	..	..	13	58 0	7 0	13	..	..	13	39 0	7 0	13	..	..	13
From deck to cheeks	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Top-mast and pole	28 0	6 0	7	..	..	8½	38 0	8 0	8½	..	..	8½	23 0	4 6	9	..	..	..
Fore-mast and sq.-sail yard	62 0	9 0	15	54 0	2 3	9	49 0	6 6	12	38 0	2 6	8	47 6	6 0	13	35 0	1 0	7
Top-mast and yard	20 0	..	7½	34 0	2 0	7	26 0	3 9	7½	30 0	1 9	7½	16 0	..	6½	31 0	1 0	7
Topgallant-mast and yard	10 0	3 0	..	24 0	1 3	6	12 0	8 0	..	21 0	1 6	5	9 0	3 0	..	24 0	0 9	6½
Bowprit	29 0	..	15	..	..	..	28 0	..	13	..	..	..	22 6	..	15	..	..	..
Jib-boom	30 0	..	8½	..	..	..	..	..	7½	..	..	..	22 0	2 0	4	..	..	..
Pole	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Main-boom	46 0	..	10	..	..	10	39 0	..	10	..	..	..	28 0	..	9	..	..	..
Gaff	24 0	..	7	..	..	7½	27 0	..	7½	..	..	..	27 0	..	4	..	..	..
Fore-boom	..	..	..	..	..	..	..	..	..	..	..	..	25 0	..	5	..	..	..
Gaff	..	..	..	..	..	..	..	..	..	..	..	..	22 0	..	..	..	..	..
Fore-topmast, studding-sail, boom, and yard	..	..	..	..	..	..	..	..	..	..	..	..	25 0	..	6½	10 0	..	2½
Fore-topgallant-mast, studding-sail, boom, and yard	..	..	..	..	..	..	..	..	..	..	..	..	12 0	..	3	7 0	..	2
Swinging-boom and yard	..	..	..	..	..	..	..	..	..	..	..	..	33 0	..	6½	9 0	..	2½

DIMENSIONS OF MASTS AND YARDS OF SCHOONERS.

NAMES OF THE MASTS AND YARDS.	Schooner of 5 keels.						Schooner of 80 tons.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast	49 0	6 6	12	..	..	..	47 0	8 0	11	..	..	..
Top-mast and pole	29 6	5 6	7½	..	..	..	26 0	5 0	7	..	..	..
Fore-mast and yard	43 0	6 6	12	35 0	1	7½	46 0	10 0	12	33 0	1 6	6½
Top-mast and yard	15 9	..	7½	27 0	1 4	6	26 0	4 0	7½	27 0	1 2	5½
Topgallant-mast and yard	7 8	..	..	19 0	1 0	4½	11 0	..	4½	19 0	0 9	4½
Pole	5 6	..	..	..	..	..	..	..	..	..	..	..
Bowsprit	24 0	..	11	..	..	..	25 0	..	11½	..	..	..
Jib-boom	25 0	3 0	7	..	..	..	23 6	..	6½	..	..	..
Main-boom	33 0	..	7½	..	..	..	31 0	..	7½	..	..	..
Gaff	24 6	..	8½	..	..	..	21 0	..	7	..	..	..
Fore-boom	20 0	..	6½	..	..	..	23 0	..	6½	..	..	..
Gaff	18 0	..	6	..	..	..	20 0	..	6	..	..	..

DIMENSIONS OF MASTS AND YARDS OF STEAM-VESSELS.

NAMES OF THE MASTS AND YARDS.	Iron Steamer of 700 tons.										Steam-vessel of 350 tons.										Iron Steamer of 2½ tons										
	Dimensions of Ship: Length, 170 ft.; Breadth, 29 ft.										Dimensions of Ship: Length, 140 ft.; Breadth, 22 ft. 6 in.										Dimensions of Ship: Length, 148 ft.; Breadth, 30 ft. 6 in.										
	Masts or Booms.					Yards.					Masts or Booms.					Yards.					Masts or Booms.					Yards.					
	Extreme Length.	Headed Length.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	Length.	Arm.	Diameter.	
Main-mast and yard	68 0	8 0	15	52 0	3 0	10½	10½	10½	15	41 0	1 10	11½	13½	7 8	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	
Top-mast and yard	25 0	4 0	10	36 0	2 0	8½	40 6	7½	7½	31 0	3 6	5½	7½	7 8	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	
Torygallant-mast and yard	26 6	8 0	..	25 0	1 6	6	6 0	..	..	18 6	0 10	4	13 0	7 6	..	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Fore-mast and yard	70 0	8 0	15	52 0	3 0	10½	53 9	7 8	15	41 0	1 10	11½	13½	7 8	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½	13½
Top-mast and yard	28 0	4 0	10	36 0	2 0	8½	37 0	..	8½	31 0	3 6	5½	7½	7 8	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½
Torygallant-mast and yard	27 0	8 0	..	25 0	1 6	6	10 6	1 10	..	18 6	0 10	4	13 0	7 6	..	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Dowsprit	36 0	..	15	30 6	12 0	13
Jib-boom	13 0	..	8	27 6	..	6½

DIMENSIONS OF MASTS AND YARDS OF STEAM-VESSELS.

NAMES OF THE MASTS AND YARDS.	Steam Ship of 1920 tons.										Steam Ship of 1315 tons.										Steam Ship of 983 tons.									
	Dimensions of Ship : Length, 250 ft.; Breadth, 42 ft.										Dimensions of Ship : Length, 195 ft.; Breadth, 35 ft.										Dimensions of Ship : Length, 180 ft.; Breadth, 33 ft.									
	Masts or Booms.					Yards.					Masts or Booms.					Yards.					Masts or Booms.					Yards.				
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.			
Main-mast and yard . . .	Pt. In. 106 0	Pt. In. 14 0	Ins. 20½	Pt. In. 86 0	Pt. In. 3 6	Ins. 19	Pt. In. 86 0	Pt. In. 3 6	Ins. 19	Pt. In. 90 0	Pt. In. 12 0	Ins. 22	Pt. In. 90 0	Pt. In. 12 0	Ins. 22	Pt. In. 90 0	Pt. In. 12 0	Ins. 22	Pt. In. 90 0	Pt. In. 12 0	Ins. 22	Pt. In. 74 0	Pt. In. 12 0	Ins. 16	Pt. In. 74 0	Pt. In. 12 0	Ins. 16			
Top-mast and yard . . .	67 0	..	13½	66 0	8 9	13	66 0	8 9	13	67 0	..	11	67 0	..	11	67 0	..	11	67 0	..	11	40 6	..	8½	40 6	..	8½			
Topgallant-mast and yard . . .	12 0	..	..	39 0	1 8	8½	39 0	1 8	8½	10 0	..	..	10 0	..	..	10 0	..	..	10 0	..	..	8 0	..	..	8 0	..	..	
Fore-mast and yard . . .	100 6	14 0	28	86 0	8 6	19	86 0	8 6	19	80 0	12 6	22½	80 0	12 6	22½	80 0	12 6	22½	80 0	12 6	22½	68 6	10 0	17½	68 6	10 0	17½			
Top-mast and yard . . .	63 6	..	15	66 0	8 9	13	66 0	8 9	13	51 0	..	12	51 0	..	12	50 0	6 8	92	40 0	..	10	46 0	3 10	7½	40 0	..	10			
Topgallant-mast and yard . . .	19 6	5 0	..	80 0	1 8	8½	80 0	1 8	8½	16 6	4 0	..	29 6	1 8	6½	13 0	2 0	..	31 6	1 0	5½	..	..	..	..	..	..
Mizen-mast . . .	37 6	10 0	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Top-mast . . .	52 0	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Topgallant-pole . . .	8 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bowsprit . . .	48 8	..	25	..	..	..	..	..	..	38 6	..	19	38 6	..	19	..	..	..	33 6	..	14	..	..	..	..	..	..
J'b-boom. . .	46 6	..	13	..	..	..	..	..	..	35 0	..	10	35 0	..	10	..	..	..	31 0	..	7½	..	..	..	..	..	..

. DIMENSIONS OF MASTS AND YARDS OF AN AMERICAN
STEAM-SHIP OF 680 TONS.

	Ft. In.		Ft. In.		Ft. In.		In.
Main-mast	74 0	Head . 12 0	.. ..			Diameter	24½
Fore-mast	70 0	.. 12 0	.. ..			"	25
Mizen-mast	54 6	.. 10 0	.. ..			"	18½
Fore and main top-mast .	42 0	.. 7 6	.. ..			Cap . .	14½
Topgallant-mast . . .	22 0	Hoist . 14 6	Royal . 9 0			Pole-cap.	8½
Mizen-top-mast . . .	33 0	Head . 5 6	.. ..			Cap . .	11
Top-gallant-mast . . .	18 0	Hoist . 12 0	Royal . 7 0			Pole . .	6½
Main and fore-yard . .	68 0	.. ..	Arms . 4 0			Sling . .	15½
Topsail-yard	54 0	.. ..	" . 4 7			" . .	13
Topgallant-yard . . .	37 0	.. ..	" . 2 7			" . .	7½
Royal-yard	25 7	.. ..	" . 1 3			" . .	5½
Mizen-yard	54 0	.. ..	" . 4 7			" . .	13
Topsail-yard	39 0	.. ..	" . 3 7			" . .	9
Topgallant-yard . . .	26 7	.. ..	" . 1 11			" . .	6½
Royal-yard	19 0	.. ..	" . 1 0			" . .	4
Bowsprit, outboard . .	25 7	.. ..	.. ..			Bed . .	25
Jib-boom, ditto . . .	24 0	Inboard 20 0	Head . 3 0			Cap . .	13½
Flying-jib-boom, ditto .	19 0	.. ..	" . 5 0			" . .	8½
Spanker-boom	47 7	.. ..	" . 2 0			Diameter	9
Gaff	39 0	.. ..	" . 8 0			"	7
Swinging-booms . . .	45 7	.. ..	.. ..			"	8
Top-mast stud-sail-booms	35 0	.. ..	.. ..			"	7
Topgallant ditto . . .	28 0	.. ..	.. ..			"	5½
Royal ditto	19 0	.. ..	.. ..			"	3½
Lower ditto	17 0	.. ..	.. ..			"	5
Top-mast ditto . . .	21 0	.. ..	.. ..			"	5
Topgallant ditto . . .	16 0	.. ..	.. ..			"	4
Royal ditto	10 0	.. ..	.. ..			"	3
Mizen try-sail-mast . .	38 0	.. ..	.. ..			"	7½
Housing of Fore-mast .	20 5						
Main-mast	20 8						
Mizen-mast	7 1						
Length between perpen- diculars	156 0						
Spar-deck	165 2						
Keel	142 10						
Extreme breadth of beam	30 0						

DIMENSIONS OF MASTS AND YARDS OF STEAM-VESSELS.

NAMES OF THE MASTS AND YARDS.	Iron Steamer of 320 tons.						Steamer of 250 tons.						Iron Steamer of 180 tons.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Dimensions of Vessel: Length, 143 ft.; Breadth, 21 ft.			Dimensions of Vessel: Length, 125 ft. 6 in.; Breadth, 22 ft.			Dimensions of Vessel: Length, 125 ft. 6 in.; Breadth, 22 ft.			Dimensions of Vessel: Length, 125 ft. 6 in.; Breadth, 22 ft.			Dimensions of Vessel: Length, 125 ft. 6 in.; Breadth, 22 ft.			Dimensions of Vessel: Length, 125 ft. 6 in.; Breadth, 22 ft.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast	Pt. In.	Pt. In.	In.	Pt. In.	Pt. In.	In.	Pt. In.	Pt. In.	In.	Pt. In.	Pt. In.	In.	Pt. In.	Pt. In.	In.	Pt. In.	Pt. In.	In.
From deck to hounds	35 6	7 0	13	..	..	..	55 6	8 0	14	..	..	..	35 9	6 0	13	..	..	..
Top-mast to stops	26 6	..	6	..	..	..	32 10	..	7	..	..	..	21 9	..	5½	..	..	..
Pole	5 0	..	..	..	..	..	5 9	..	..	..	..	..	4 6	..	..	..	..	..
Fore-mast and yard	..	..	..	40 0	2 6	11	54 6	8 0	14	..	..	..	..	..	..	38 0	2 0	10
From deck to hounds	34 6	7 0	13	..	..	..	35 6	..	..	..	..	..	33 7	6 0	13	..	..	..
Top-mast to stops and yard	29 0	..	5½	31 6	2 6	6½	24 9	..	7	..	..	..	18 0	..	5	29 0	1 6	6
Torgallant-mast and yard	0 6	..	5	23 0	1 0	5	10 0	..	5	..	..	..	9 0	..	4½	21 0	1 0	5
Royal pole	1 8	..	..	..	..	..	1 8	..	..	..	..	..	1 6	..	..	..	..	..
Mizen-mast from deck to hounds	32 0	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pole	14 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bowsprit, outboard	19 6	..	13	..	..	..	17 0	..	13	..	..	..	12 0	..	12	..	..	..
Jib-boom, ditto	10 0	..	6	..	..	..	16 0	..	6	..	..	..	18 0	..	7	..	..	..
Main-boom	30 6	..	7½	..	..	..	48 0	..	10	..	..	..	35 0	..	9	..	..	..
Fore-boom	33 0	..	8	..	..	..	..	..	..	..	..	..	28 0	..	6½	..	..	..
Mizen-boom	24 0	..	6	..	..	..	..	..	..	..	..	..	26 6	..	6½	..	..	..
Main-gaff	29 0	..	8	..	..	..	23 6	..	6	..	..	..	21 3	..	6	..	..	..
Fore-gaff	29 0	..	8	..	..	..	23 6	..	6	..	..	..	..	..	..	..	..	..
Mizen-gaff	19 0	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Distance from stern to fore-mast	35 6	..	..	..	..	..	26 0	..	..	..	..	..	..	..	..	..	..	..
From centre of fore-mast to main-mast	56 6	..	..	..	..	..	57 0	..	..	..	..	..	..	..	..	..	..	..
From centre of main-mast to mizen-mast	31 6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
From centre of mizen-mast to taffrail	13 6	..	..	..	..	..	42 6	..	..	..	..	..	..	..	..	..	..	..

DIMENSIONS OF MASTS AND YARDS OF YACHTS.

NAMES OF THE MASTS AND YARDS.	Schooner Yacht of 177 tons.						Schooner Yacht of 173 tons.					
	Dimensions of Vessel: Length, 90 ft.; Breadth, 23 ft.						Dimensions of Vessel: Length, 77 ft.; Breadth, 18 ft. 8 in.					
	Masts or Booms.			Yards.			Masts or Booms.			Yards.		
	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.	Extreme Length.	Headed Length.	Diameter.	Extreme Length.	Arm.	Diameter.
Main-mast	73 0	7 4	18	73 0	2 3	9	52 0	6 9	17	48 0	2 0	8
From deck to bounds	..	..	..	..	..	..	..	..	..	..	..	..
Top-mast	24 0	..	7	..	..	..	29 0	..	9	..	..	..
Top-mast-pole	8 7	..	..	..	..	..	9 0	..	..	..	..	..
Fore-mast and yard	73 0	7 4	19	55 0	2 3	9	..	..	..	..	..	..
From deck to bounds	..	..	..	..	..	..	50 0	6 6	17	30 0	2 3	7
Top-mast to steps and yard	18 6	7 4	7 4	23 2	4 0	7	18 0	..	7 4	20 0	1 0	5
Totgallant-mast and yard	8 6	31 0	6	23 0	1 0	9	10 0	..	6	..	..	..
Totgallant-pole	4 0	..	..	..	..	..	8 0	..	..	..	..	..
Bowsprit, outboard	12 0	..	17	..	..	13	15 0	..	17	..	..	..
Jib-beam, ditto	39 0	..	10	..	..	8	17 0	..	6	..	..	..
Flying-jib-boom, ditto	..	..	..	..	..	..	12 6	..	5	..	..	..
Main-boom	50 5	..	11	..	..	12	44 0	..	10	..	..	..
Main-gaff	..	..	8	..	..	8	27 6	Pole.	8	..	..	..
Fore-gaff	24 4	..	6	..	..	8	26 0	2 0	8	..	..	..
Gaff-top-sail-gaff	23 6	..	..	..	..	..	26 0	2 0	..	..	..	..
	..	..	..	..	..	..	7 6	..	3	..	..	..

• The celebrated American Yacht.

PROPORTIONS GIVEN FOR MASTS AND GEAR OF BOATS DIFFERENTLY RIGGED.

SLIDING GUNTER SAILS.

Length of boat, 32 ft.; breadth, 8 ft. 6 in. or 8.5 ft.

Species of Masts and Gear.	Known quantities.	Proportions.	Length.	Diameter.
Main-mast	Breadth	8·5	18·7 foot	6½ inches.
Fore-mast	Main-mast	18·7	"	"
Mizen-mast	Ditto	18·7	"	"
Main-slide	Ditto	53	10·0 "	3½ "
Fore-alcid.	Ditto	1·0	18·7 "	4½ "
Mizen-alcid.	Fore-mast	17·5	"	"
	Mizen-mast	10·0	17·5 "	4½ "
Bowsprit	Length	32·0	10·0 "	2½ "
Outrigger	Ditto	32·0	8·0 "	5 "
Main-mast from the middle	Ditto	34	11·0 "	4 "
Fore-mast ditto		·053	"	"
Main-mast to rake, in a foot, 14 inches.		·398 = 10·5 "	1·7 before.	"
Fore-mast ditto			"	"
Mizen-mast ditto			"	"

LATEEN OR BETTER SAILS.

Length of boat, 32 ft.; breadth, 8.5 ft.

Species of Masts and Gear.	Known quantities.	Proportions.	Length.	Diameter.
Main-mast	Breadth	8.5	18.3 feet	6 1/2 inches
Fore-mast	Main-mast	18.3	"	"
Mizen-mast	Ditto	18.3	"	5 1/2 "
Main-yard	Length	32.0	"	4 "
Fore-yard.	Main-yard	32.0	26.5 "	6 "
Mizen-yard.	Ditto	26.5	25.0 "	5 1/2 "
Outrigger.	Length	32.0	15.0 "	3 1/2 "
Main-mast from the middle	Ditto	38	12.2 "	4 1/2 "
Fore-mast ditto	Ditto	312	1.2 abaft, 10.0 before.	"

PROPORTIONS GIVEN FOR MASTS AND GEAR OF BOATS DIFFERENTLY RIGGED.

CUTTER WITH THREE LUGSAILS, SQUARE AT THE HEADS.

Length of boat, 26 ft.; breadth, 6'5 ft.

Species of Masts and Gear.	Known quantities.			Proportions.	Length.	Diameter.
	Breadth.	Main-mast.	Mizen-mast.			
Main-mast	Is equal the	6'5	15'6	2'4	15'6 feet	4 inches.
Fore-mast			15'6	9'2	14'3 "	3 1/2 "
Mizen-mast			15'6	6	9'3 "	2 1/2 "
Main-yard			26'0	5	13'0 "	3 1/2 "
Fore-yard			13'0	9	11'7 "	2 1/2 "
Mizen-yard	Is equal the		13'0	6'3	8'2 "	2 1/2 "
Main-mast from the middle			26'0	0'34	8 before.	
Fore-mast ditto			26'0	0'37	7'4 "	
Outrigger.			26'0	4	10'4 feet	4 "

CUTTER WITH THREE LUGSAILS, NARROW AT THE HEADS.

Length of boat, 28 ft.; breadth, 7 ft.

Species of Masts and Gear.	Known quantities.			Proportions.	Length.	Diameter.
	Breadth.	Main-mast.	Mizen-mast.			
Main-mast	Is equal the	7'0	18'9	2'7	18'9 feet	4 1/2 inches.
Fore-mast			18'9	9	17'0 "	4 1/2 "
Mizen-mast			18'9	6	11'3 "	2 1/2 "
Main-yard			28'0	38	10'6 "	2 1/2 "
Fore-yard			10'6	86	9'1 "	2 1/2 "
Mizen-yard	Is equal the		10'6	55	5'8 "	1 1/2 "
Main-mast from the middle			28'0	34	9'5 "	4 "
Fore-mast ditto			28'0	0'15	4 abaft.	
Fore-mast to rake, in a foot, 1 inch.			28'0	0'15	4 abaft.	
Mizen-mast ditto as the transom.			28'0	28'1	7'3 before.	

PROPORTIONS GIVEN FOR MASTS AND GEAR OF BOATS DIFFERENTLY RIGGED.

GEO. WITH FORE AND MAIN LUGSAILS.

Length of boat, 23 ft.; breadth, 6 ft.

Species of Masts and Gear.	Known quantities.			Proportions.	Length.	Diameter.
	Breadth	Main-mast	Main-yard			
Main-mast	6.0	16.2	10.6	2.7	16.2 feet	4 inches
Fore-mast				.9	14.5 "	3 1/2 "
Main-yard		28.0	10.6	.38	10.6 "	2 1/2 "
Fore-yard				.86	9.1 "	2 1/4 "
Main-mast from the middle		28.0		.015	4 abaf.	
Fore-mast ditto		28.0		.231	7.8 before	
Main-mast to rake, in a foot, 1 inch.						
Fore-mast ditto						

GEO. WITH ONE LUGSAIL.

Length of boat, 20 ft.; breadth, 5 ft. 6 in. or 5.5 ft.

Mast is equal the breadth	5.5 multiplied by 2.7 = 14.85 feet long	Diameter 3 1/2 inches
Yard is equal the length.	.5 = 10. feet long.	2 1/2 "
Mast from middle, length	.4 = 8. feet before.	

END OF RUDIMENTARY MASTING OF SHIPS.

To commence with *Rigging*, it is necessary that the young student should practise the following, while preparing for a nautical life.

TO MAKE AN OVERHANDED KNOT.

To make an overhanded knot, pass the end of the rope over the standing part and through the bight, as the annexed sketch.



FIGURE OF EIGHT KNOTS.

Take the end of the rope round the standing part, under its own part and through the lower bight, and the knot is made.



SQUARE OR REEF KNOT.

First make an overhanded knot, supposing it be round a yard; then bring the end being next to you over the left hand and through the bight; haul both ends taut, and it is made as per sketch.



TO MAKE A BOWLINE KNOT.

Take the end of the rope in your right hand, and the standing part in the left; lay the end over the standing part, then with your left hand turn the bight of the standing part over the end part; then lead the end through the standing part above, and stick it down through the cuckold's neck formed on the standing part, and it will appear as the sketch.



TO MAKE TWO HALF-HITCHES.

Pass the end of the rope round the standing part, and bring it up through the bight—this is one half-hitch; two of these, one above the other, constitute two half-hitches, as the annexed figure.



A TIMBER-HITCH.

Take the end of the rope round a spar; pass it under and over the standing part, then pass several turns round its own part and it is done. The bight serves as a sling for bales, drawing of timber, &c.





A ROLLING-HITCH.

With the end of a rope take a half-hitch around the standing part; then take another through the same bight, jamming it above the first hitch and the upper part of the bight, then haul it taut, and lay the end above the hitch around the standing part, and stop the end back with a yarn.



A BLACKWALL-HITCH.

To make a Blackwall over a hook, you form a bight or a "kink" with the rope, having it underneath and the hook on the top; stick the hook through the bight, keeping the bight well up on the back of the hook (as shown in the figure), until the tackle is set taut. This is better learned by practice than it can be described.



BOWLINE UPON THE BIGHT OF A ROPE.

Take the bight of the rope in one hand and the standing part in the other; throw a cuckold's neck or a kink over the bight with the standing parts, the same as for the single knot. Take the bight round the parts, and over the large bights, bringing it up again; jam all taut, and it will appear as the sketch.



A RUNNING BOWLINE.

Take the end of the rope round the standing part, through the bight, and make a single bowline upon the running part, and it is done.



A CAT'S-PAW, FOR SETTING UP SHROUDS, ETC.

To form it, lay the end part of the rope or laniard over the standing part, and middle of the bight, then breaking it down, and turning it three times over both parts, and hook the tackle on to both bights.

A COMMON BEND.

Pass the end of a rope through the bight of another rope, or through the becket of a block; then round and underneath the standing part, as shown in the sketch. To prevent it jamming, pass it round twice under the standing part. The sheet of a sail has the end passed up through the clue, then round the clue, and underneath the standing part.



A CARRICK BEND.

This bend is often used in haste, to bend hawsers together, or to form a greater length of warp to tow with. In forming this bend, lay the end of the hawser across its standing part; take the end of the other hawser, and lay it under the first standing part at the cross and over the end; then pass the end down through the bight again on the opposite side from the other end, observing that one end must be on the top, and the other underneath, as is seen in the adjoining sketch.



A FISHERMAN'S BEND.

Take two round turns with the end of a rope or hawser through the ring of an anchor, or round a spar, and one half-hitch around the standing parts, and under all parts of the turns; then one half-hitch around the standing part above all, and stop the end to the standing part; or dispensing with the last half-hitch, tuck the end under one of the round turns, and it becomes a *studding-sail bend*.



A ROLLING BEND.

This is something similar to a fisherman's bend. It is two round turns round a spar, two half-hitches around the standing part, and the end stopped back.



A SELVAGEE STRAP.

A selvagee is used to hook a tackle to any rope, shroud, or stay, to stretch or set up, it being not so likely to slip as a rope strap; two or more turns of the selvagee are taken round



the rope in which the hook of the tackle is fixed. To make a selvagee strap, get a couple of spike nails and drive them into any convenient place, as far distant as the length intended for the strap; make the end of a ball of rope-yarns fast to one of the spikes, then take it round the other one, and keep passing the rope-yarn round and round in this manner, hauling every turn taut, until it is as stout as it has to be.

When it is to be a very large strap, it is marled down with stout spun-yarn; if of middling size, with two single rope-yarns; and if a small strap, a single rope-yarn.

A PUDDING FOR A MAST OR YARD.

Take a piece of rope of the required length, and splice an eye in each end; put it on a stretch, then worm it, and parcel it with worn canvas according to the shape wanted. By the sketch it will be seen that



they are made large in the middle, tapering gradually towards the ends, and made flat on the side which goes next the yard or mast. When made to the size required, marl it down, beginning in the middle, and marling both ways to the eyes. If the pudding is for a yard, it is commonly covered with thick leather or green hide; but when for a mast, it is neatly pointed over.

TO FORM AN EYE-SPLICE.

An eye-splice forms an eye or circle at the end of a rope, on



itself or round a block. The strands are first unlayed, and laying the strands at any distance upon the standing part of the rope, according to the size of the eye-splice required, open the lay of the rope with a fid or a marline-spike, and put the middle strand through first, then pass it over the surface of the second strand, and push it through the third; repeat the same with the two

other ends, laying them fair apart, observing to taper the strands by gradually reducing the yarns.

AN ARTIFICIAL EYE.

Take the end of a rope and unlay one strand to a certain length, and form the eye by placing the two strands along the

standing part of the rope and stopping them fast to it; then take the odd strand and cross it over the standing part, and lay it into the vacant place which it was taken from at first; work around the eye, filling up the vacant strand until it comes out at the crutch again, and lies under the other two strands; the ends are tapered, scraped down, marled, and served over with spun-yarn.



THE CUT OR CONT SPLICE.

This is to form an eye in the middle of a rope, as the eye-splice doth at the end. Cut the rope in two, and unlay the strands of each; then lay the ends of one rope on the standing part of the other, and stick the end through between the strands similar to an eye-splice, and do the same with the other ends, so that the rope becomes double in the extent of the splice. This splice or collar is occasionally used for pendants, jib-guys, breast-backstays, odd shrouds, &c.



A FLEMISH EYE OR MADE EYE.

Unlay the end of a rope, then open the yarns, divide them into parts, and take a piece of round wood the size intended to make the eye, and half-knot about one-half of the inside yarns over the piece of wood; scrape the remainder down over the others; then well marl, parcel, and serve them together. This makes a snug eye for the collars of stays.



A SHORT SPLICE.

A short splice is made by unlaying the ends of two ropes, or the two ends of one rope to a sufficient length, then crutch them together, as per adjoining sketch; draw them close, and push the strands of one under the strands of the other, the same as the eye-splice. This splice is used for block-straps, slings, &c. If the ends are to be served over, they are but once stuck through; if not, they are stuck twice and cross-whipped across the strands, so as to make them more secure. When the ends are to be served, take a few of the underneath yarns, enough to fill up the



lay of the rope for worming, then scrape or trim the outside ends, and marl them down ready for serving.

A LONG SPLICE.

A long splice is made to rejoin a rope or ropes, intended to reeve through a block, without increasing its size. To make it,



unlay the ends of the ropes to a sufficient length, which may be from one half to a whole fathom in length, crutch them together in the same manner as a short splice; one strand is then unlayed, and the opposite strand laid up its intervals; then turn the rope round and lay hold of the two next strands that

will come opposite their respective lays; unlay one and fill up with the other as before; the ends are then split equally in two, and the two opposite half strands are knotted together at the ends and middle of the splice, so as to fill up the vacant lay; then stick the ends twice under two strands with all six of the half strands, leaving the other six neutral; the splice is then well stretched before cutting off the ends, and it is finished.

A long splice of four-strand rope is made in a similar way as the preceding.

TO WORM AND SERVE A ROPE.

Worming a rope is to fill up the contlines or vacant space between the strands of the rope with spunyarn or small rope, in order to strengthen it, and to render the surface smooth and fair for parcelling.



The first end of worming is securely stopped, and, when arrived at the end of the length intended to be served, it is there stopped, then laid back into the second vacant space; and so on successively, stopping it at the ends.

Parcelling a rope is wrapping old canvas about it, cut in long narrow slips, well tarred and rolled up in rolls before commencing to lay it on the rope. It is customary with some to put on parcelling with the lay of the rope in all cases; but for rigging, which is not intended to be served over, the parcelling ought to be put on the contrary way.

Serving a rope is encircling it with line or spunyarn, &c., to keep it from rubbing and chafing. The end of the spunyarn, for service, is placed under the two or three first turns to keep it fast; then two turns are taken round the mallet and rope, as shown in the sketch. The mallet is then turned round the rope by its handle, while a boy passes



the ball of spunyarn at some distance from the man that is serving the rope, and passes it round as he turns the mallet, until the rope is covered the length required; when the mallet is within a few turns of the end, take the turns off the mallet and pass them by hand, the ball or end is put through under the three or four last turns of the service, and hauled taut, where it is made fast, as at first.

CHAPTER VIII.

To put a Strand in a Rope.—To make a Grommet.—To Sheep-shank a Rope or Back-stay.—To make a Turk's Head.—Wall Knot.—To Wall and Crown.—Shroud Knot.—A French Shroud Knot.—A Matthew Walker.—A Spritsail-sheet Knot.—A Diamond Knot single.—A Diamond Knot double.—Common Sennit.—A Sea Gasket.—A Wrought or Panch Mat.—A Harbour Gasket, or French Sennit.—Pointing a Rope.—A Stopper Knot.—Buoy-rope Knot.—To clap on a Throat and Quarter-seizing.—To pass a Rose-lashing.

TO PUT A STRAND IN A ROPE.

This is done when it happens of one strand of a rope getting chafed or magged, and the other two remaining good. To manage this, cut the strand at the place where it is chafed, and unlay it about two feet each way; then take a strand of a rope about the same size, and lay it in the vacancy of the rope, as shown in the sketch, and stick the ends the same as a long splice, and it is done.



TO MAKE A GROMMET.

A grommet is made by a strand of a rope, and placing one part over the other; with the long end follow the lay, until it forms a ring or small wreath with three parts of the strand all round; finish it by knotting and splicing the ends the same as a long splice.



TO SHEEP-SHANK A ROPE OR BACKSTAY.

This is done to shorten a backstay, when the mast is struck; the rope is doubled in three parts, as shown in



the figure, and taken a hitch over each bight with the standing part of the backstay, and jammed taut.

TO MAKE A TURK'S HEAD.

To make this, take a round turn round the rope with a piece of log-line, cross the bights on each side of the round turn, and stick one end under one cross and the other under the other cross; it will then be formed like the middle figure of the sketch: after which follow the lead until it shows three parts all round, and it will form the Turk's head.



Turk's heads are generally made on man-ropes, and some times on the foot-ropes of jib-booms, in lieu of an overhanded knot, as they are much neater than the knot, and thought by many seamen an ornament.

WALL-KNOT.—TO WALL AND CROWN.



To form a Single Wall.



Single Wall.



To form a Single Wall and Crown.



Single Wall and Crown.



Walled, Crowned and Walled.



Double Walled and Double Crowned, or Man-rope Knot.

To make the wall, unlay the end of a rope, and with the three strands form a wall knot, by taking the first strand and forming a bight; take the next strand and bring it round the end of the first, the third strand round the second, and up through the bight of the first; this is a wall. To crown this, lay one end over the top of the knot, which call the first, then lay the second

over it, the third over the second, and through the bight of the first. It will then appear as the sketch. To *Double Crown*: this is made by unlaying the strands sufficiently, and there making a stop with rope yarn; then single wall and crown, then double wall and double crown, and haul the end tight, and jam the knot: then the strands are led down through the walling, and laid down in the contline; tapered, marled, and served over with spunyarn.

SHROUD KNOT.

Unlay the ends of two ropes about four feet, and interplace one in the other, the same as you commence to make a short splice; then a single wall-knot is made with the ends on each standing part, and the end laid in the contline, tapered down, and served over with spunyarn. This knot is used when a shroud is either shot or carried away.



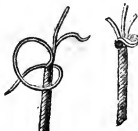
A. FRENCH SHROUD KNOT.

Place the ends of two ropes as the preceding, drawing them tight together; then lay the first three ends back upon their own part, and single wall the other three ends round the bights of the other three and the standing part; it will then appear like the annexed sketch. The ends are tapered as the last. This knot is much neater than the common shroud knot.



A MATTHEW WALKER.

A Matthew Walker is made by separating the strands of a rope, and taking the first strand round the rope and through its own bight; then take the second end round the rope underneath through the bight of the first, and through its own bight; the third end take round the same way, underneath and through the bights of all three. Haul them taut, and they form the knot as the sketch. It is a handsome knot for the end of a laniard, if well made.



A SPRITSAIL-SHEET KNOT.

Unlay two ends of a rope about two feet, and place the two parts which are unlayed together; form a bight with one strand,



and wall the six together against the lay of the rope, the same as was done in a single wall with three ends; after this is walled with the six ends, haul them taut; you must then crown with the six ends, and it will appear as the sketch. To complete it, follow the lead of the parts, and double wall and crown it.

A DIAMOND KNOT SINGLE.

The strands of the rope are unlayed a sufficient length to make the knot; then form bights, by laying the three strands down the sides of the rope, and keep them fast with your left hand; then pass the end of the first strand over the bight of the second strand and through the bight of the third; then take the second over the third and through the bight of the first; then the third over the first and through the second. Haul these taut, and lay the ends of the strands up again to the next knot. These knots are used as ornaments upon bell-ropes, and for jib-boom foot-ropes, man-ropes, &c.



A DIAMOND KNOT DOUBLE.

This is made by the several strands following their respective places through the bights of the single knot, the ends coming out at the top of the knot; lay the ends of the strands up as before.



Common Sennit is braided cordage, made by plaiting from three to any number of rope yarns together, one over the other, according to the size and length, always keeping an odd yarn.



A *Sea Gasket* is made by taking three or four foxes, according to the size required to make the gasket: three or four are plaited together, long enough to make the eye; this being done, clasp both parts together to form the eye over a belaying-pin, and plait it by bringing the outside foxes on each side alternately over to the middle; the outside one is laid with the right hand, and the parts held steadily until the whole is together, adding a fox when necessary. When of a sufficient length to taper, diminish by leaving out a fox at proper

intervals. At the finish of it, one end is laid up, allowing enough to form a bight; then plait the others through this bight a few times; the end which was laid up is hauled tight to secure all parts. The ends are cut off, and the end is whipped.

A Wrought or Panch-Mat.—A small rope or line is stretched in a horizontal direction, and made fast at each end, across which foxes (according to the breadth the mat is to be made) are middled and hung over it; then beginning with the first next the left hand and twist a turn in the two parts, and one part give to the man opposite (two men being employed to work the mat); the next fox has a turn twisted in its two parts, and one part given back to the



opposite man; the remainder are twisted round the first which are given back, and then again round its own part, and so on in succession. This will make the mat downwards; and, when finished to the length intended, it is begun again at top till its breadth is completed. Each twist is to be pressed tight, and each couple of foxes is to be twisted together at the bottom, to keep in their twists till the next in succession are interwoven with them. At the bottom of the mat selvage it by taking another small rope or line across in a tight manner, similar to the head-line, round which one fox is half-hitched while the next fox is laid up at the back of it, and so on alternately. Trim the ends off, and thrum it with pieces of old strands of rope, cut in pieces about three or four inches long; open the lays of the foxes with a small marline-spike, push the thrums through the lays, and open their ends out.

A Harbour Gasket, or French Sennit, is made with foxes, something similar to the common sea gasket; but, instead of taking the outside fox over all the rest, and bringing it into the middle, it is interwoven between them by taking the outside fox of both sides, and taking it over one and under the other, working it towards the middle, the same as common sennit.



Pointing a Rope.—Unlay the end of the rope a sufficient length, and stop it; open the strands out into yarns, and take out as

many as it will require to make the knittles,* by splitting the yarns and making one knittle out of every outside yarn; when they are made, stop them back on the standing part of the rope; then form the point with the rest of the yarns, by trimming and scraping them down to a proper size, and marl it down with twine. Divide the knittles, taking every other one up and every other one down; then take a piece of twine, called the warp, and with it pass these turns very tight,



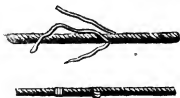
taking a hitch with the last turn every time passing the warp or tilling. Then take the knittles which are up and bring them down, and the ones which are down, up; hauling them tight, and passing the warp every time over the lower knittles; proceed in this manner until it is got almost to the end, reserving enough of the knittles to finish it with; leave out every other bight of the knittles of the last lay, and pass the warp through the bight, haul them taut and cut them off. A becket is sometimes worked in the end.

A STOPPER KNOT.



This is made by double-walling and crowning, which has been described in page 78. The ends are put up through the heart, and whipped at top.

BUOY-ROPE KNOT.



Unlay the strands of a cable-laid rope, take one strand out of the large ones, and then lay the three large ones up again as before; take the three small ones which were left out, single and double them round the standing part of the rope; then

take and worm the spare ends along the lay, and stop them.

TO CLAP ON A THROAT AND QUARTER-SEIZING.

To make a round or quarter-seizing,† splice an eye in one end of the seizing, and taking the other end round both parts of the

* Knittles are made by laying rope yarns together, with your finger and thumb, against the twist of the yarn.

† Seizing is joining two parts of a rope together with spunyarn, houseline-marline, or small cordage.

rope that the seizing is to be put on ; then reeve it through the eye, pass a couple of turns and heave them hand taut ; then make a kind of cat's-paw on the seizing by the *marline-spike*, and laying the end over the standing part, push the *marline-spike* down through, then under the standing part, and up through the bight again. Heave these two turns well taut with the spike, pass the rest and heave them taut in the same manner, making six, eight, or ten turns, according to the size of the rope ; then push the end through the last turn, and pass the riding turns five, seven, or nine more (which are termed *riders*), always laying one less of the riding than of the first turns. These are not to be hove too taut, that those underneath may not be separated. The end is now pushed up through the seizing, and two cross-turns taken between the two parts of the rope and round the seizing, leading the end under the last turn, and hove well taut ; make an overhanded knot on the end of the seizing, and cut off close to the knot.

When the seizing is put on the end of a rope, and round the standing part, it is called an *End-Seizing*. If on the two parts below the end, a middle or *Quarter-Seizing*.

A *Throat-Seizing* is passed the same way, with riding turns, but not crossed with the end of the seizing. A bight is formed by laying the end over the standing part ; the seizing is then clapped on, the end put through the last turn of the riders, and knotted. The end part of the rope is turned up, and fastened to the standing part ; this is used for turning-in dead-eyes, hearts, blocks or thimbles.

TO PASS A ROSE-LASHING.

This lashing is passed crossways over and under one eye, then under and over the other ; the end part is afterwards taken in a circular form round the crossing, and the end tucked under the last part. This circular part is done to expend the end, instead of cutting it off, so that it will answer again for the same purpose. The use that this is applied to is in lashing a strap or pudding round a mast or yard, or the parral-lashing of a topgallant-yard.

CHAPTER IX.

Blocks.—A Shell, Pin, and Sheave.—Names of the different Blocks, and their uses.—A Single Block.—A Double Block.—A Treble Block.—A Shoulder Block.—A Fiddle Block.—A Shoe Block.—A Sister Block.—A Dead-Eye.—A Bull's-Eye.—A Heart.—Belaying-Pin Rack.—A Euphroe.—Ninepin Block.—Monkey Block.—Strapping of Blocks.—A Tail Block.—A Purchase Block.—A Top Block.—A Cat Block.—A Snatch Block.—The Spring Block.—A Single Whip.—Whip and Runner.—A Gun-tackle Purchase.—A Luff-tackle Purchase.—A Top Burton-tackle.—A Runner and Tackle.—A Long-tackle.—A Two-fold Purchase.—A Three-fold Purchase.

BLOCKS.—A SHELL, PIN, AND SHEAVE.

BLOCKS are used for various purposes in a ship, either to increase the mechanical power of the rope, or to arrange the ends of them in certain places on the deck; and they may be readily found when wanted: they are consequently of various sizes and power, and obtain various names according to their form or situation.

Every block consists of three, and generally four, parts:—1. The shell, or outside wooden or iron part. 2. The sheave, or wheel, on which the rope runs. 3. The pin, or axle, on which the sheave turns. 4. The strop, or part by which the block is made fast to any particular station, and is usually made either of rope or of iron. *Iron-stropped Blocks* frequently have the hook working in a swivel in order to turn it, that the several parts of the rope of which the tackle is composed may not be twisted round each other, which would greatly diminish the mechanical power.

The shell of a block is made of ash, elm, or iron, and has one or two scores cut at each end, according to its size; these scores are for the purpose of admitting a strap, which goes round the block, in the centre of which is a hole for the pin; the shell is hollow inside to admit the sheave.

The sheave is a solid wheel, made of lignum vitæ, iron, or brass; in the centre is a hole for the pin, on which it turns.

The lignum vitæ sheave is bushed with brass or iron; round the circumference a groove is cut, that the rope which goes over it may play with ease. The sheave is placed in the shell, and the pin is put through both shell and sheave, which constitute a block.

NAMES OF THE DIFFERENT BLOCKS, AND THEIR USES.

What is termed a single block has but one sheave, and if intended for a double strap there are two scores on the outside of the shell. Single blocks are more used than any other kind on board of a ship.



A *double block* has an additional sheave; it is otherwise the same as a single block.



A *treble block* is made in the same manner as a double, with one more sheave. Treble blocks are generally used as purchase blocks.



A *Shoulder block* is the same as a single block, with the exception that it has a projection at the bottom of the shell, called a shoulder, to prevent the rope that reeves through it from jamming between the block and the yard. These blocks are mostly used for bumkin or lift-blocks on lower yards.



A *Fiddle block* is made like two single blocks, one above the other; the upper one being the largest, so as to allow the rope which is rove in the upper sheave to play clear of the rope in the under one. These blocks are used in places where there is not space enough for a double one, or where it (the double block) would be liable to split by not "canting" fair, or having room to play. These blocks are used for top burtons, &c.



A *Shoe block* is also made like two single blocks, but the sheave of the upper one lies in a contrary direction to that of the lower one. They are generally used as buntline blocks to courses; the buntline reeving in the upper sheave, and the whip in the lower one.



A *Sister block* has two sheave holes one above the other; three scores for seizings, one at each end, and one between both sheaves; they are hollowed out on each side of the shell to take the shroud. These blocks are used as topsail lift and reef-tackle blocks, and are seized-in between the two forward shrouds of the topmast rigging, above the futtock stave. The lift reeves through the lower sheave, and the topsail reef-tackle through the upper one.



A *Dead-eye* is a large round piece of wood with three holes in it, and a groove cut round it for the shroud to lie in. It is used to turn in the ends of shrouds and backstays; the three holes are used to reeve the rope or lanyard through, which is well greased to reduce the friction when setting up the shroud or backstay. The round shape of the block, and the position of the three holes,



give it somewhat the shape of a death's head, and hence its name, "the Dead-eye."



A *Bull's-eye* is a kind of thick wooden thimble, with a hole in the centre, and a groove cut round the outside for the rope or seizing to lay in.



A *Heart* is a peculiar sort of dead-eye, resembling a heart; it has one large hole in the centre, at the bottom of which are four or five scores, and round the outside is a groove cut to admit a rope called a stay. There are other hearts, called "collar-hearts," which are open at the lower ends, opposite to which the laniard is passed. This heart has a double score cut round the outside, and two grooves cut on each side for the seizing to lay in, which keeps the collar in the scores of the heart. Hearts intended for bob-stays should be made of lignum



vitæ; those made of ash being liable to split.



A *Belaying-Pin Rack* is a piece of wood with a number of holes through it, in which belaying-pins are stuck; on the back part are several scores for the shrouds to lie in, to which it is seized.



A *Euphroe* is a long piece of wood, having a number of holes, through which the legs of the crowfoot is rove; a score is cut round it to admit of a strap. This is used for the ridge of an awning.



Ninepin Block.



Monkey Block.

STRAPPING OF BLOCKS.



The whole length of all the different sizes of block-strap is got upon the stretch, and hove out taut for worming and serving; it is then wormed and served, and the required number cut into lengths to suit the different blocks. A common strap is fitted in the following manner:—First cut the rope once-and-a-half the round of the block, then get it on a stretch; worm, parcel, and serve as near the end as possible, not to interfere with splicing; then splice the ends together with a short-splice, and finish serving snug up to the splice. Stretch it and cut the ends off, or serve over the ends.

TABLE OF THE DIMENSIONS OF STRAPS AND SEIZINGS
FOR SINGLE AND DOUBLE BLOCKS.

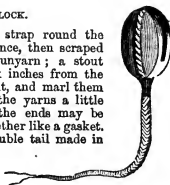
Size of Blocks.	Size of Strap.	Length when spliced for Single Blocks.	Seizing for Single Blocks.	Length when spliced for Double Blocks.	Seizing for Double Blocks.
Inches.	Inches.	Ft. In.	Marline.	Ft. In.	Marline.
5	1½	1 5	6 feet	1 7	6 feet
6	2	1 6	6 "	1 9	6 "
7	2	1 0	7 "	2 0	7 "
8	2½	2 0	9 "	2 3	10 "
9	3	2 3	11 "	3 0	13 "
10	3	3 0	13 "	3 3	15 "
			Rope.		Rope.
			In. Fms.		In. Fms.
11	3½	3 8	½ 2½	3 6	½ 3
12	4	3 6	½ 3	3 9	½ 3½
13	4	3 0	½ 3½	4 3	½ 3½
14	4½	4 2	1 3½	4 6	1 3½
15	5	4 5	1½ 3½	4 9	1½ 4
16	5½	4 8	1½ 4	5 1	1½ 4
17	6	5 1	1½ 4	5 7	1½ 4
18	6½	5 7	1½ 4	6 2	1½ 4
19	7	6 1	1½ 4	6 9	1½ 4
20	7½	6 9	2 3½	7 4	2 3½

NOTE.—In cutting straps from the 3-inch rope upwards, 18 inches more length will be required for splicing, &c.; under 3-inch, 12 to 15 inches.

Blocks strapped with eyes or thimbles in the ends, are seized tight into the bight, and the legs left long enough to lash through the eyes, round the mast, yard, &c., as the topsail clue-lines, clue-garnets, &c. Girt-line blocks are strapped with a lashing eye or tail, and the girtline rove. Blocks, strapped with double tails, are fixed in the strap, similar to blocks with eye-straps; and those with a single tail, called—

A TAIL-BLOCK.

An eye-splice is made in the strap round the block; the ends are stuck but once, then scraped down, and served over with spunyarn; a stout whipping is clapped on about six inches from the splice. Then open the strands out, and marl them down selvagee fashion, tapering the yarns a little towards the end of the tail; or, the ends may be twisted into foxes, and platted together like a gasket. Blocks used for jiggers have a double tail made in the same manner.



A PURCHASE-BLOCK.



bring them into their proper place.

This block is double strapped, having two scores in the shell for that purpose; the strap is wormed, parcelled, and served, or only wormed and parcelled, and spliced together. It is then doubled so as to bring the splice at the bottom of the block. The seizing is put on the same way as any other; the only difference is that it is crossed both ways through the double parts of the strap. These block-straps are so large and stiff, that it requires a purchase to set them securely in the scores of the block, and

A TOP-BLOCK.



This is a single iron-bound hook-block; it hooks to an eye-bolt in the cap. The topendants are rove through the top-blocks when swaying up or lowering down the topmasts.

A CAT-BLOCK.



The cat-block is a two or three-fold block, iron-bound, with a large iron hook attached to it, and is employed to draw the anchor up to the cat-head. On the forward side of the shell of this block are two small eye-bolts, for the purpose of fitting a small rope, called the back-rope bridle, used in hooking the cat.

A SNATCH-BLOCK.



about blocks."

A snatch block is a single block, iron-bound with a swivel hook. An iron clasp is fitted on the iron band or strap, with a hinge to go over the opening or snatch, and toggles on the opposite side. The bight of a rope or a hawser is placed in this block when warping the ship, &c., instead of reeving the end through, which, in some circumstances, would be very inconvenient. Blocks of this description, and of a large size, are generally termed "viol, or rouse-

THE SPRING-BLOCK.

The spring-block is an invention of Hopkinson, of Philadelphia, calculated to assist a vessel in sailing, and particularly intended by him to be applied to the sheets and the dead-eyes; it is composed of a common block or dead-eye, attached to a spiral

spring of well-tempered steel, within the cavity of which is a chain of suitable strength, called a check-chain; when the spring is not in action, this chain is slack; but when the spring is extended by the force of the wind as far as it may be without injury, the check-chain begins to bear, and prevents its farther extension.

A SINGLE WHIP.

A single whip is the smallest and most simple purchase in use. It is made by reeving a rope through a single block, as the annexed sketch. It is used to hoist up light bodies out of the hold, such as empty casks, &c.



WHIP AND RUNNER.

A rope rove through a single block is called a whip as above; and if the fall of this whip be spliced round the block of another whip, it becomes whip on whip, or whip and runner. Thus two single blocks will afford the same purchase as a tackle having a double and a single block, and with much less friction. To topsail and topgallant yards that hoist with a single tie, there is sufficient length of the hoist to apply the purchase as halliards, which will overhaul with great facility.



A GUN-TACKLE PURCHASE.

This purchase is made by reeving a rope through a single block, then through another single block, and make the end fast to the one it was first rove through, or splice it into the bottom of the block for neatness.



A LUFF-TACKLE PURCHASE.

Luff-tackles are composed of double and single blocks, strapped with a hook and thimble; the rope is rove through one of the sheave holes of the double block, then through the single one, through the double one again, and the end made fast to the single one, with a becket bend, to a becket in the bottom of the block.





A TOP BURTON TACKLE.

This is rove in the same manner as a luff-tackle purchase; the only difference is that the upper block of the burton is a fiddle block, while that of the luff is a double one.



A RUNNER AND TACKLE.

A runner tackle is the same purchase as a luff-tackle applied to a runner. A runner is a thick rope rove through a single block, and has usually a hook attached to one of its ends, and one of the tackle blocks to the other: in applying it, the hook of the runner, as well as the lower block of the tackle, is fixed to the object intended to be removed.



A LONG TACKLE.

A long tackle is composed of two blocks; a long tackle block is double, but it resembles two single blocks joined together at their ends.

A *Two-fold Purchase* consists of two double blocks; the fall is first rove through one sheave of the upper block; then through one of the lower ones; through the upper one again, then through the lower one, and make the end fast to the upper block.

A *Three-fold Purchase* is rove in this way: the blocks having one more sheave, commence to reeve the fall in the middle sheave first, instead of one of the side ones, which brings a cross in the fall. The reason of its being rove in this manner is that the heaviest strain comes first on the fall part, and if it was rove in the side sheaves it would have a tendency to *cant* the block in the strap, split the shell of the block, and cut the fall; but when it is in the middle sheave it draws all down square alike.

CHAPTER X.

Drawing Plans for Cutting Rigging.—Drawing a Rigging Plan for Shrouds.—Cutting out Standing Rigging.—Backstays (Breast and Standing).—Fore-and-Aft Stays.—Cutting Lower Mast-head Pendants.—Puttock Shrouds.—Bobstays.—Bowsprit Shrouds.—Jib and Flying-jib Guya.—Turning-in Dead Eyes.—Cutter, stay-fashion.

DRAWING PLANS FOR CUTTING RIGGING.

THE most proper way to ascertain the lengths of all standing and running rigging, is to make a *draft*, or rigging plan of the vessel you are employed upon, drawing it to a scale of reduced proportion to the real dimensions, as the 8th or 4th of an inch to the foot, as may be convenient for the drawing.

To draw the plan of rigging for a new ship, it is necessary to have the dimensions of the hull, as:—

The distance between the foreside of the stem to the centre of the foremast.

The distance between the centre of the foremast to the centre of the mainmast.

The distance between the centre of the mainmast to the centre of the mizenmast.

The distance between the centre of the mizenmast to the outside of the taffrail.

The housing of the foremast.

" " mainmast.

" " mizenmast.

The step of the foremast above a straight line from the step of the mainmast.

The step of the mizenmast ditto ditto.

The number of inches the foremast rakes to the foot.

" " mainmast "

" " mizenmast "

" " bowsprit rises to the foot.

The height of the rail or gunwale.

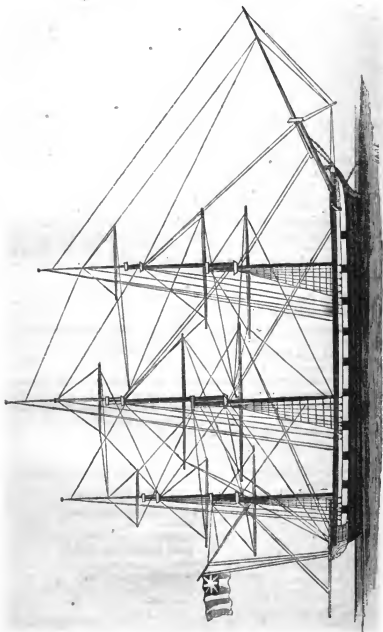
" " topgallant forecastle.

" " poop.

" " cathead or bumkins.

Also, the dimensions of masts, yards, gaffs, &c.

[See the adjoining plate.]

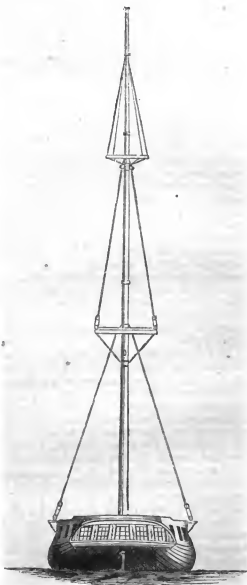


DRAWING A RIGGING PLAN FOR SHROUDA.

Lower Shrouds.—

For the length of the shrouds of lower rigging, draw the breadth of the ship from outside of the channels to outside of the channels, from the same scale as the sheer or broadside plan is drawn; set up the height of the masts above the deck to the boulds, and diameters of them. Draw the rigging as the adjoining sketch; then will the distance from the larboard side of the mast-head to the foremost dead-eye in the starboard channels, be the length of the *first* pair of shrouds, making due allowance for the size of the dead-eyes and for stretching in setting up.

As the shrouds spread to channels, which are placed aft of each mast, as shown in the plate, their respective lengths are ascertained by applying the length of the shrouds of the foremost ones on this draft, which is a guide for each shroud of the carry-aft. Measure them in the same manner as those in the annexed sketch; but allowing for each pair of shrouds to lap over the diameter of the



rope at the eye on the mast-head. The length of the shrouds must vary inversely as to the rake of the mast. The greater the rake, the shorter the aftermost shrouds.

Topmast and Topgallant Rigging.—The lengths are found in the same way.

In measuring the length of the shrouds, some prefer the distance from the opposite side of the mast-head to the partners, added to half the breadth of the deck, from the mast to the side.

CUTTING-OUT STANDING RIGGING.

Lower Rigging.—When the rigging plan is completed and the length measured, get the shroud warp on a stretch, or rather one end of it, long enough for one pair of shrouds; mark off the distance for the required service; and, when completed, being wormed, parcelled, and served, on a taut stretch for a few days (the longer time the better), measure the length with a tape-line, of first pair of shrouds, No. 1, starboard; when measured and chalked the required length, slacken down the stretch, and cut at the chalk-mark; middle the shroud at the centre of the service, and lay it on the rigging-loft floor for turning in the dead-eyes, &c. Continue fitting, and cutting, from the *draft*, in this way until is cut the number of shrouds required for the gang, allowing each pair of shrouds to lap over the diameter of the rope at the eye, as they are laid on the loft-floor; alternately making due allowance at the ends, before cutting, for the carry-aft, or the jump of a port, if required. But the exact length of each is easily got from the rigging plan.

In worming, start before the shrouds are hove out to lengthen, because the worming increases in tension with the rope, and thereby draws smooth and even into the contine. In parcelling, begin at each end where the service is to leave off, and parcel upwards to the middle of the eye, where commence serving downwards on each leg. The eye-seizings are round ones, and when put on, the whole eye is neatly covered with parcelling. A half-sister block is sometimes put on between the two forward shrouds, for the lower boom topping lift.

Top-mast and Topgallant Rigging is cut in the same manner. In fitting the top-mast rigging, always seize in a sister-block between the two forward shrouds, for the top-sail lift and reef-tackle. The swifterns are generally served the whole length.

The eyes of the topgallant rigging are made to fit exactly around the cylinder; if there is an odd top-mast shroud, or topgallant-shroud, on each side, they are either fitted with a horse-shoe eye, or go together with a cut splice.

BACKSTAYS.

Breast and Standing, are stays which support the top-mast,

topgallant, and royal-masts from aft; they reach from the heads of their respective masts to the channels on each side of the ship, and assist the shrouds when strained by a press of sail, as shown in the plate, p. 92.

These may be cut by the same rule; the eyes of the breast backstays are fitted in different ways. They are sometimes spanned together, making a square, the size of the mast-head; sometimes they have an eye like the shrouds, made to fit close; and others have a small eye seized in the bight, and lashed round the mast-head. The eyes of the standing backstays are fitted like those of the shrouds.

FORE AND AFT-STAYS.

These being marked on the rigging plan (see plate, p. 92), measure from the after parts of the mast-head to where the stays set up, and to this distance add the length of the mast-head, for collars.

Collars for stays are the length of their respective mast-heads. The mousings are raised once and a half the size of the stays, and at a distance equal to twice the length of the mast-head from the mousing. A Flemish eye is worked on the end, and the stay rove through it; or they may be fitted with lashing eyes, in which case each leg is the length of the mast-head; the service is continued the length of the eye below the mousing, the collars parcelled or leathered, and the hearts turned in with the lay of the rope. Stays are wormed, parcelled, served, and leathered in the wake of all nipps, such as the bees, bullock-blocks, and sheave-holes.

CUTTING LOWER MAST-HEAD PENDANTS.

The forward pair should be twice the length of the mast-head,—the after pair twice and a half; thimbles are spliced in the ends, and they are wormed or spanned together, so as to form a span to fit the mast-head.

PUTTOCK SHROUDS.

The distance from the extremity of the top to the puttock-hoop, or chain-necklace, will give the length of the puttock-shrouds, which must have a hook and thimble in their upper ends, and a thimble in their lower ends. The puttock shrouds are hooked to their respective plates in the tops, *with the points of the hooks in*. See sketch, p. 13.

BOBSTAYS.

The bobstays of all merchant vessels are chain, which are fitted with shackles to the cutwater, with iron plates let in

flush with the wood, a bolt going through both plates; the other ends are set tight by screws to the hoops on the bowsprit. See p. 20.

BOWSPRIT SHROUDS.

These are of chain, and the length may be found by making an athwartship plan of the rigging of the bowsprit. A dead-eye or heart is attached to the end which sets up to the collar or hoop on the bowsprit, and a hook at the other, to hook to the eye-bolts in the bows.

JIB AND FLYING-JIB GUYS.

Take the distance from the boom-end to the spritsail-yard-arm, and from thence to the bows, if an athwartship *draft* be made; or make an allowance for reeving through the spritsail-yard. They are generally fitted with a cuckold's-neck over the boom end, and set up with dead-eyes to the bows.

When no spritsail-yard is carried, the jibboom is secured by guys to the outriggers commonly called *whiskers*, which are placed just inside the bowsprit caps; but sometimes extend out from the fore part of the cat-heads, and in this case made of iron, with sheaves at the extremity, through which the jib-guys lead, and are set up inboard.

The martingales must be cut, and fitted to the manner in which they are rove.

TURNING-IN DEAD-EYES.

Take the length of the shroud from the draft, if the masts are not stepped, and place the dead-eye to that length, as directed in p. 93. Turn the dead-eye in as near the end as possible, so that all parts of the shroud may be equally stretched, observing to keep the lay in the rope, as it prevents the wet getting in. The score of the dead-eye being well tarred, is thus turned in,—the end of the shroud is taken underneath round the dead-eye, inside standing, or mast-head part; a bolt is put in a hole of the dead-eye. The dead-eye machine (a pair of screws) is fixed on, and the shroud is hove in quite snug round the dead-eye.

When the shroud is hove well round, pass a good throat-seizing; when secured, bring the end taut up; then pass a round, or quarter seizing, and a smaller one on the end.

There is one thing of importance, and should be observed in turning rigging-in on shore—to keep the lay in the rope, and when sent out of the loft, to be placed on the mast-head, keep the ends inside, the shrouds being marked with a knot or a piece of spunyarn, according to the number. The ends will lay aft on one side, and forward on the other.

CUTTER STAY FASHION.

Turning in dead-eyes, termed *Cutter-stay fashion*.—The dead-eye being placed to the mark, the end is passed round it as before, but instead of being secured with a throat-seizing, the end is passed round the standing-part, and seized to the part round the dead-eye with a round-seizing, and another on the end round the dead-eye.

CHAPTER XI.

Rigging Sheers.—To take in the Mizzen-mast.—To take in the Main and Fore-mast.—To take in the Bowsprit.—Gammoning the Bowsprit.—Rigging the Fore, Main, and Mizzen-masts.—Lower Tackle—Pendants, Shrouds, Swifters, Stays, the setting up of the Lower Rigging.—Rigging the Bowsprit—Bobstays, Bowsprit Shrouds, Blocks for the Fore-bowline, Blocks for the Foretop-bowline, Horses or Ridge-ropes, the Goblins or Back-ropes.—Getting the Tops over.—Rigging the Top-mast—Getting the Cap into the Top, the Top Tackle Falls and Blocks, getting Top-mast Cross-trees over, Ginn-blocks, placing Top-mast Rigging, to seize in the Sister Blocks, the Top-mast Cap, the Standing After Back-stays, the Fore Top-mast-stays, Main Topmast-stay, Main Topmast Spring-stay, Mizzen Topmast-stay.

RIGGING SHEERS.

EVERY facility is afforded at Her Majesty's dock-yards for lifting the lower masts and the heavier parts of rigging on board, by large "Sheers;" a detailed description of which is given in p. 84, "Rudimentary Construction of Cranes," by Joseph Glynn, Esq, F.R.S. As merchant ships have not recourse to these, and it is only a few places else have got them, as in the East India Docks, London; the new docks at Sunderland, &c.; it becomes necessary to get such spars as can be procured, and erect a pair of sheers on board for that purpose.

In doing this proceed as follows:—Take in a sufficiency of ballast, or coals, to steady the ship, if tender, and shore the decks from the skin up, particularly abreast of the partners. Sling "skids" up and down the sides, for the purpose of keeping the sheer legs clear of the channels; reeve the "parbuckles," (see p. 20, "Construction of Cranes,") and bring the sheer legs alongside with their small ends aft; parbuckle them on board, and their heads or after ends resting either on the taffrail, the break of the poop, or a spar placed in the most

convenient spot, the more elevated the better. Square the heels exactly one with the other, so that when they come to be raised the legs may be found of equal height.

As near the after ends of the spars as may be considered necessary, when crossed, put on the head-lashing of new, well-stretched rope (figure of 8 fashion), similar to a racking-seizing, and cross with the ends. Open out the heels, carrying one over to each gangway, and placing it on a solid piece of oak or shoe, previously prepared for the purpose. Clap stout tackles on the heels, two on each, one leading forward, the other aft; set taut the after ones, and belay them. Lash a three or four-fold block, as the upper one of the main purchase, over the main-lashing (so that it will hang plumb under the cross), with canvas underneath to prevent chafing; and in such a manner that one-half the turns of the lashing may go over each horn of the sheers, and divide the strain equally; also sufficiently long to secure the free action of the block. Lash the small purchase-block on the after horn of the sheers, sufficiently high for the falls to play clear of each other, and a girtline-block above all.

Middle a couple of hawsers, and clove-hitch them over the sheer-heads—having two ends leading forward, and two abaft, led through vial blocks, and stout-luffs clapped on them. These should be sufficiently strong to secure the sheers while lifting the masts. The lower purchase block is lashed forward, round the knight-heads (perhaps round the cut-water), and the fall being rove, the sheers are raised by heaving upon it, and preventing the heels from slipping forward, by means of the heel-tackles previously mentioned.

Sometimes a small pair of sheers are erected for the purpose of raising the heads of the large ones.

When the sheers are up, the heels confined to their "shoes," they can then be transported along the deck by means of the heel-tackles and guys to the situation required, taking care to make them rest upon a beam, and to have the deck properly shored up below.

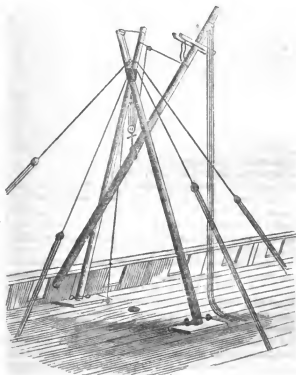
Finally, give the sheers the necessary rake by means of the guys, and set taut all the guys and heel-tackles, &c.; this being done, the sheers may be considered ready.

TO TAKE IN THE MIZEN-MAST.

The mizen-mast being alongside, with the head aft, and the garland* lashed on to the forward part of the mast at the distance from the tenon to just above the spar-deck partners;

* Garlands are made of new rope, well stretched (selvageo fashion). they are laid on the forward part of the mast, a stout lashing put on over all, and crossed between the garland and the mast; a good dogging also, if necessary, passed downward.

lash a pair of girtline-blocks on the mast-head, and reeve the girtlines; bend the sheer-head girtline to the mast below the bibbs, to "cant" it. Overhaul the main purchase down abaft, thrust the strap through the eyes of the garland, toggle it, and secure the toggle by a back lashing. Take the fall to the capstan and "heave round;" when the heel rises near the rail, hook on a heel-tackle to ease it inboard. Get the mast fair for lowering by means of the girtlines, wipe the tenon dry, and white lead, or tar both it and the step, "lower away," and step the mast.



Some distance may be saved, by using no garlands and having the purchase-blocks lashed to the mast.

The mast being stepped, and wedged temporarily, "come up" the purchases, man the guy and heel-tackles, and transport the sheers forward for taking in the main-mast.

* TO TAKE IN THE MAIN AND FORE-MAST.

Proceed in the same manner as in getting in the mizen-mast. It is better not to use garlands, when the sheer legs are rather

short, as lashing the purchase-blocks to the mast shortens the distance. If the ship has a topgallant-forecastle, it would be well to step the mast forward of the sheer legs, for the brake of the forecandle comes abreast of the partners; and, in a case of this kind, it would be well to take in the foremast first.

TO TAKE IN THE BOWSPRIT.

Transport the sheers as far forward as possible, or as the bows will permit; send a man to the sheer-head, bend on the girtlines to the small purchase-block to light it up, unlash it, and lash it again to the forward fork or horns of the sheers, pass a strap round the fore-mast head, to which hook a large tackle, carry it well aft; and haul it taut, for the purpose of staying the mast. Lash a couple of large single blocks to the foremost head, middle, and hawser, and clove-hitch it over the sheer-head; reeve the ends through the blocks at the mast-head, down on deck, carry them well aft, and take a turn. Hook the after-heel tackles forward, and take the after-guys aft; pass a bulwark lashing round each heel, rake the sheers over the bows sufficiently for the main purchase to hang directly over the gammoning-scuttle, and make all fast.

The bowsprit being brought under the bows, with the head forward, and the garlands lashed on, the main one a little more than one-third from the heel, the smaller one between the cap and bees, having guys leading from the bowsprit to the cat-heads, and a couple of straps round the heel for hooking the bedding tackles; overhaul down the purchases and toggle them; "sway away," attending it by the guys, until nearly perpendicular; hook on the bedding tackles, which are taken from the bitts on the main-deck, and led up through the partners; wipe the tenon dry, and white-lead, or tar both it and the mortice; "lower away," bouse upon the bedding-tackles, and bring it into its place; come up purchases, guys, unlash garlands, and proceed to dismantle the sheers.

If the ship has a topgallant-forecastle, the bowsprit cannot be taken in with the sheers without the assistance of a *derrick*, on account of the brake of the forecandle, it not being prudent to step sheers on the top of it.

When the ship is masted, and alongside the yard, commence getting on board tops, caps, cross-trees, top-masts, and topgallant-masts; also have ready tackles and luffs for setting up the rigging and staying the masts, top-blocks, with lashings for top-ropes, and all the rigging at hand and in order.*

* See "The Kedge Anchor; or, Young Sailor's Assistant," by William Brady, of the U. S. Navy; in reference to which, I have much pleasure in acknowledging the use I have here made of several articles in his most unique and useful book.

When extreme expedition is not wanted, the following is the usual progressive method of rigging ships :

GAMMONING THE BOWSPRIT.

It is necessary that a stage should be rigged under the bowsprit for this purpose, and slung from the bowsprit end. The gammoning is of new, well-stretched rope ; chains generally in the merchant service. One end is passed over the bowsprit, and through a hole cut in the knee of the head, alternately. The first end, if rope, is whipped and passed through the hole, and over the bowsprit, with a round turn, then clinched round the bowsprit close against the cleats or stop ; the other end passes through the forepart of the hole, again round the bowsprit, but before the clinch on the bowsprit and aft in the hole. All the succeeding turns go in the same way. A selvagee, or lashing, is put round the cutwater, to which a block is hooked abreast of the hawse-hole, through which a pendant is led through the block, with an eye in its outer end, to which a bight of the gammoning is toggled every turn, while to the other end is hooked a long tackle, and the fall led to the capstan. When all the turns are passed and hove taut, they are frapped together by as many cross-turns as are passed on the bowsprit, each turn hove tight. The end is then whipped and seized in one of the turns. Iron gammoning is put on in a similar way.

RIGGING THE FORE, MAIN, AND MIZEN-MASTS.

Before the trestle-trees are sent up, white-lead the mast-head in the wake of them ; overhaul down the girtlines and bend on the trestle-trees, with the after chock out ; "sway away ;" when above the bibbs slip the stops so as to let them come down gradually into their places ; then the after chock is sent up, let in and bolted. Tar the mast-head in the way of the rigging ; overhaul again the girtlines for the bolsters, which are covered with well-tarred canvas ; sway them aloft and stop them. The girtline-blocks are now lashed to the after part of the trestle-trees.

The girtlines that reeve through them lead down upon the deck, for hoisting the rigging in the following manner :—

Lower Tackle Pendants.—These are sent aloft and placed, they have got a long and short leg, fitted together with a span, or square, the size of the mast-head. As soon as the mast-head pendants are placed they ought to be lashed abaft, the tackles hooked, and the mast stayed by them.

Shrouds are hoisted over the mast-head. Thus,—Overhaul down the girtlines, bend the mast-head one on the shroud, with a timber-hitch, or toggle, four or five feet below the seizing

and stop it to the centre of the eye; take the girtline from the after trestle-tree, and bend it half way down the shroud; then "sway away" on the lower girtlines, and lift the weight of the shroud. When high enough, the stop in the eye is cut, and it will fall over the mast-head; the persons employed to place the rigging laying it fair on the bolsters, beating it well down, and observing to have the eye-seizing come as near the centre of the mast-head as possible. In this manner, hoist foremost pair of shrouds, starboard-side, the next pair forward on the port side; and so on, alternately, until all the shrouds are over.

Swifters are swayed over the mast-head, next above the shrouds (the after swifter goes over first in small vessels), and are fixed on the starboard and port sides of the mast. In staying the mast these swifters should be set taut, the mast being previously wedged, and the stays set steadily up.

The *Stay* is next sent up, and last of all the *Preventer or Spring-stay*.

The Setting-up of the Lower Rigging.—Reeve the end of the lanyard, if prepared, through the hole of the upper dead-eye nearest to the end, and stopped with a wall-knot, to prevent its slipping; the other end is passed through the hole of the lower dead-eye, and returning upwards, is rove through the middle hole in the upper dead-eye, and next through the middle hole of the lower dead-eye, and lastly, through the foremost hole in both dead-eyes. Clap a selvagee-strap on the shroud well up, to this hook the single block of a luff-tackle; the double-block, to a blackwall-hitch in the lanyard; the fall is then made fast to the hook of the main tackle with another cat's-paw or blackwall; reeve the tackle fall through the leading block, and pull up, the lanyard being well greased, to make the whole slide with ease through the holes in the dead-eyes. When the rigging is set up for a full due, (which is when the masts are stayed forward and the stays all set up,) the lanyard is first nipped, or stopped, and the end passed between the throat-seizing and the dead-eye with a hitch, then brought round all the parts in turns to expend the lanyard, and the end is well stopped to its own part with spunyarn. The ends of the shrouds are then cut square and capped, and the mats laced on.

RIGGING THE BOWSPRIT.

Bobstays.—Chain is generally used in the merchant service, and fitted to shackle to the cutwater, with iron plates let in flush with the wood, a bolt going through both plates, which is very snug and strong. A heart, or iron-bound dead-eye, is attached to the outer-end, and a lanyard then passes through and connects with the heart, or iron-bound dead-eye, in the iron collar under the bowsprit, and sets up taut, with luff-

tackle upon luff, and leads in upon the forecastle. Ships have two or three bobstays, according to their size. Their uses are to bind down and keep steady the bowsprit, and counteract the force of the stays of the foremast, which draw it upwards.

Bowsprit shrouds are single pieces of chain hooked to an eye-bolt on each side of the bow; the foremost end has a heart or iron bound dead-eye linked on; the shrouds are then set taut as the bobstays.

Blocks for the fore-bowlines are spliced, one on each side of the forestay.

Blocks for the fore-top-bowlines are seized, one on each side, to an eye-bolt in the bowsprit-cap.

Horses, or Ridge-ropes.—The outer ends are spliced round a thimble in an eye-bolt on each side of the upper part of the bowsprit cap. The inner ends have a thimble seized in that sets up with a lanyard to an eye-bolt in the knight-heads or stanchions for the purpose.

The goblins or *back-ropes*, whether rope or chain, are fitted to the end of the dolphin-striker, and set up to the bows, one on each side.

GETTING THE TOPS OVER.

The girtlines are overhauled for the cross-trees, are then hoisted into their places, and bolted in the trestle-trees, which are screw-nutted or fore-locked underneath. The top is hoisted on board by the girtlines, and placed up against the aft-side of the mast, except the mizen, which is placed on the fore-side. The girtlines being on each side of the mast-head are then overhauled; one end is passed from underneath, and up through the hole for puttock-plates; hitch it to the standing part, and stop it with spunyarn through the hole made for the slings in the fore-part, except the mizen-top, which is stopped at the aft-part. A girtline is taken from the mizen-mast head, and bent to the foremost part of the maintop; bend on a tripping-line to the pigeon-hole leading from the foremost-head. The top is then hoisted by its girtlines over the mast-head; when sufficiently high to allow the foremost edge of the lubber's-hole to clear the mast-head, cut the stops and cant it over by the tripping-line, and the top will hang in the girtlines, when it can be lowered, placed in its berth, and bolted.

The dead-eyes for the topmast-rigging can now be hauled up, and put in their places in the top-rims, and also ship the top-rail, and puttock shrouds in their respective place.

The top-blocks are large single blocks having iron straps, which are formed, after being put round the block, into a large hook (see sketch, p. 88). Overhaul down the girtlines through the lubber's-hole; then bend one part through the sheave-hole of the block, and stop it to the back part of the hook. The block

is then hoisted up, and lash it to the mast-head around the hook, with a lashing long enough to allow the block to hang half-mast-head high. Through this block reeve a hawser, and send the foremost end down through the square hole in the foremost part of the trestle-trees, the after end through the lubber's-hole, through a leading block on deck, and round the capstan.

RIGGING THE TOPMAST.

The hawser being already rove, reeve the foremost end through the sheave-hole in the heel of the topmast, when it is racked to the topmast in two or three places, between the heel and the hounds; it is then well stopped with a good lashing, and enough of the end to spare to make fast round the mast-head. The other end is taken to the capstan, through a leading block on the deck, and the mast hove up. When the topmast is hove high enough to enter the trestle-trees, the end of the hawser is clinched round the mast-head and the rackings are cut, the men in the top being ready to overhaul the girtlines down before all, and get the cap into the top.

GETTING THE CAP INTO THE TOP.

Reeve the foremost end of the girtline through the round-hole in the cap, and take two half-hitches; stop the girtlines along to the after part of the square-hole. Sway up the cap until it is high enough to clear the forepart of the top; lower, and place the round-hole over the square-hole in the trestle-trees, keeping the bolts in the cap *under*. The topmast is then hove well through, the men in the top being ready to place the cap over the head, and lashing it in a secure manner; a capstan bar is thrust in the fid-hole with a hauling-line on the end; it is then hove high enough for the cap to enter over the lower mast-head; haul on the line from the bar in the heel of the topmast, and it will slue the mast and bring the square hole of the cap over the lower mast-head; it is then lowered a little, and the cap placed, the lashing taken off, then beaten down into its place.

The cap being fixed securely over the lower mast-head, the topmast is hung by the up and down tackles, to unreeve the hawser. The top blocks are unlashed, then hooked to their proper bolts on each side of the cap, the top-tackle-pendant is then rove through one block, through the trestle-trees, through the sheave in the top-mast, up through the trestle-trees again, and reeve the end through the foremost bolt in the cap of the opposite side of the block (before reeving it through, parcel it well); take two half hitches on its own, or standing part, and secure the end with a round seizing. To the lower end of the top-tackle pendant is hooked (through the thimble) the

block of the top-tackle, connected, by its fall, to a block hooked to an eye-bolt in the deck, and brought to the capstan.

The top-tackle falls and blocks.—The upper block is double, strapped, which is made into a hook; the lower is also double, and should be iron-strapped, having a swivel; a single one is hooked near the double as a leading-block; the fall is rove; the standing part hitched, or clinched, over the block; they are sometimes spliced in, and some have becketts.

To hook the double block, clap a single tail-block well up on the pendant, reeve a whip through it, hitch one end of the whip through one of the sheaves of the double block, hoist it up, and hook it to the pendant.

GETTING TOPMAST CROSS-TREES OVER.

The topmast cross-trees are swayed up in the following manner:—Overhaul a girtline through the round-hole in the cap, and the after girtline outside the top. Hitch the foremost girtline, after it is through the round-hole in the cap, well out on the starboard foremost horns underneath, and secure the end with a seizing of spunyarn; the after one bend on in the same way, to the after-starboard horn; then stop both girtlines well with spunyarn, close to the trestle-trees, and, also, with two stops on the larboard horns. "Sway away," having a guy from the deck to clear it of the top, as it goes aloft. When the upper or larboard horns are well clear of the cap, take two rope's ends from the larboard side of the top, and bend them to the larboard horns, and man them in the top. These are called "steadying lines," and are used to prevent the cross-trees falling back, if a stop is cut too soon, and to assist in getting the cross-trees on the cap, and over the mast-head. The cross-trees are swayed higher; and cutting away the stops, and hauling on the steadying lines, the cross-trees will then fall across the cap; place the after hole between the trestle-trees, over the round-hole in the cap—cast off the girtlines and steadying lines—white-lead the mast-head in the wake of the cross-trees, and sway the topmast through; beat the cross-trees well down on the mast-head. The topmast is then swayed a few feet higher, for rigging.

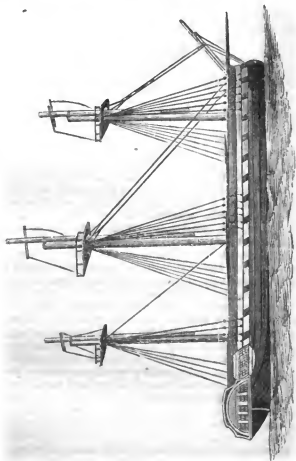
The topmasts are sometimes fidded before rigging, to avoid the greater strain upon the top-tackles.

PLACING TOPMAST RIGGING.

The following sketch exhibits the rigging thus far advanced, and the topmasts struck for placing the topmast rigging, thus:—

Tar the mast-head in the wake of the rigging and clothe the bolsters as the lower ones; then place the span for *ginn-blocks*. Some prefer chain spans to shackle the iron-bound block to.

The most approved method is an iron plate with a hook on each end, which lays across the trestle-trees. Next put over the mast-head pendants; then follow the straps, with thimble in for standing part of the tyes. The *shrouds* are swayed and



placed over the topmast-head; the first pair on the starboard side forward, then the larboard, and so on with the other pairs. *Backstays* are hoisted and placed the same as the shrouds; *stays* are swayed up and lashed abaft the topmast-head; the lower ends reeve through the bees on the bowsprit, and set up to eye-bolts in the bows with lanyards.

To seize-in the Sister Blocks.—(See sketch, p. 85.)—They are seized-in the length of the hanging-block from the eye-seizing, to

prevent any risk of the reef-tackle and lift being jammed between the hanging blocks and the rigging,—one seizing is passed round the shrouds, above the block, another below the block; and a small seizing put on each score round the block and shrouds. The topsail-lift leads through the lower sheave, and reef-tackle through the upper one.

The topmast cap is next swayed up by the girtlines, which are to be lashed well up to the topmast-head for the purpose. Overhaul down before all the foremost ends, and secure them to the foremost bolts in the cap; stop them to the centre ones, and also to the square-hole in the after part; then sway the cap up; when near up, cut the after stops, sway it upon the topmast-head, and the man aloft places it on, then beats it down firmly. The girtlines are unlashed and got down, and the topmast hove up and fiddled.

When the rigging is thus far completed, it is set up in the following manner:—

The puttock-shrouds are set up to the hoop round the mast (see sketch, p. 13), the masts stayed by the burton; the lanyards are rove through the dead-eye in the shrouds, and the dead-eye in the puttock-plate, as the lower rigging, and set up with the top burton-tackles and runners in large ships.

The standing after-backstays, when in pairs, are fitted with an eye the same as topmast rigging; they are now fitted the same size as lower rigging. The back-stays are set up with a lanyard rove through dead-eyes, the same as shrouds, to a small dead-eye in the after-end of the channel. A service is put on in the wake of the lower yards and tops.

The fore topmast-stays, set up as described, p. 106.

Main topmast-stay is fitted of the same size as the standing back-stay. A large clump block is strapped round the foremast-head, over the eyes of the rigging, and immediately over the square-hole in the after part of the trestle-trees. Through this block the main topmast-stay is rove down through the trestle-trees, it having a thimble turned in the end, a lanyard spliced and rove through it, and set up to a span shackle in the deck, abaft the foremast, for the purpose; or a large bull's-eye hooked to an eye-bolt, and set up on the end.

Main topmast spring-stay leads through a block strapped round the foremast close to the lower rigging, and sets up in the foretop.

Mizen topmast-stay is rove through a thimble strapped round the mainmast-head, over the eyes of the rigging; and when set up, is secured to its own part with round seizings.

When the *shrouds* are again set up for sea, the masts are steadied by their own stays, and not by the burtons.

CHAPTER XII.



Rigging the Jib-boom—the Traveller, Horses or Foot-ropes, Guys, Martingale-stay, Martingale-back-ropes, getting the Jib-boom out.—Sending up the Topgallant-masts—Shrouds, Backstays, the Main Topgallant-stay, the Mizzen Topgallant-stay.—Royal Rigging—the Breast and After back-stay, Royal-stays, the Fore Royal-stay, the Main Royal-stay, Mizzen Royal-stay.—Ratling the Lower and Topmast Rigging.

HAVING proceeded with the rigging thus far, the nature of its further progression is such, that many parts may be advancing at the same time; as, rigging the jib-boom, spritsail-yard, and whiskers; and getting on board and rigging the fore, main, and cross jack-yards; then the topsail yards; sending up the topgallant-masts, with their rigging and yards, and the flying jib-boom; rattling the lower and top-mast rigging, &c.

RIGGING THE JIB-BOOM.

The jib-boom being hoisted on board, run the end out on the bowsprit, pointing it through the stays and bowsprit cap. Reeve the heel-rope, and sway the jib-boom out a foot or two beyond the cap. Reeve the jib-stay through the hanks, and hook it to the *traveller*,—the traveller is first put over the outer end of the jib-boom, with the hook kept inwards. In some ships the jib-stay reeves through a sheave-hole, or only a hole, in the boom end, and a double block turned in the inner end; then a lanyard or fall is rove through this, and a single block bolted to the bows. To the traveller seize the jib downhaul blocks and travelling guys; tar the boom end, put a grommet over, to which seize the fore topgallant bowline blocks, one on each side (when used).

Horses, or Foot-ropes.—There is one on each side of the jib-boom, and are fitted thus: take a piece of rope long enough to make both, cut it in the centre and splice one end into the other with a cut splice, forming an eye to fit the jib-boom end. Four or five over-hand knots, or turk's-heads, worked through the strands, are made at equal distances on the rope from the eye, for preventing the men from slipping. In each end splice a small eye, large enough to take a lashing, by which they are set up to bolts in the bowsprit cap; or the ends are brought in and made fast, with a round turn round the jib-boom close to the cap.

Guys.—There is one pair on each side; an eye is made to fit

the boom end by passing a round seizing when in their place; the inner ends reeve through thimbles on each yard-arm of apritsail yard, or through the sheaves in outriggers, and turn into the strap of a double block, which is connected, by its fall, to a single block, that hooks to an eye-bolt in the bow, or set up to bull's-eyes, and leads upon the forecandle.

Martingale-stay, has an eye in each end to fit the jib-boom, and end of the dolphin-striker. In some ships an iron grommet is fitted with an eye on top and one underneath, neatly leathered, and put over the boom end first; the *martingale-stay* is hooked to the underneath eye, the jib-tack and downhaul to the upper one. Chain martingale is found to answer well in not being liable to stretch.

Martingale back-ropes are pendants, middled and served in the centre, the round of the dolphin-striker, both parts crossed and secured with a throat-seizing, and sets up in board with a tackle. Chain is frequently used in lieu of rope.

Getting the Jib-boom out.—The flying jib-boom iron is driven on after the rigging is placed on the jib-boom; the heel-rope being secured, the boom is hauled out; then the heel-strap is placed in a score in the heel for the purpose, and both bights lashed together; and between the boom and the bowsprit, another lashing is passed round the strap and well frapped together. The heel being secured, the back-ropes and guys are set up.

SENDING UP TOPGALLANT-MASTS.

The topgallant top-blocks being hooked, the *mast-rope* reeves for the topgallant-mast as it does for the topmast: take the end through the square hole in the fore part of the trestle-trees, half-hitch it through the fid-hole, and stop it round the hounds, and the royal mast-head; send the hauling part through the lubber's-hole, and through a leading block or sheave on deck. The topgallant rigging is fitted on a copper funnel, *a*, to slide up and down with the topgallant-mast, which, when struck, rests on the top-mast cap, as the adjoining figures.

Put on the grommet or strap for the main royal stay (if this be the fore topgallant-mast) to reeve through, then put on the *topgallant* and *flying jib-stays*. *Shrouds* next, the same as the topmast. *Breast* and *standing backstays*, the same as the topmast; then the royal-rigging and truck, and reeve the signal halyards.

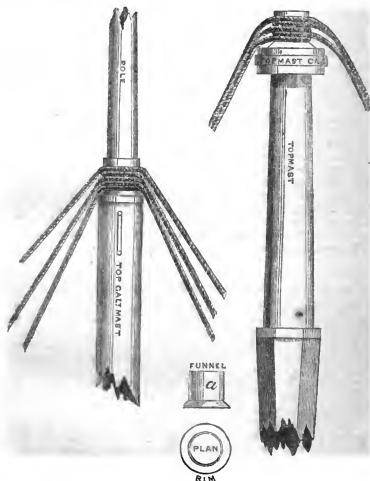
The *topgallant-mast* is then swayed up and fiddled.

Shrouds are set up thus: the ends reeve through the horns of the cross-trees, and set up to an iron *spider hoop* (round the hounds of the topmast) with eyes for the topgallant rigging to lead through.

Backstays set up the same as the topmast backstays.

The *fore topgallant-stay* reeves through the outer sheave-hole

in the jib-boom, then through a sheave-hole in the dolphin striker, and through a bull's-eye hooked to the bows, and when set up, is seized to its own part.



The main topgallant-stay is rove through a block strapped around the fore top-mast head, or through the middle sheave in the after chock of the fore topmast cross-trees, and set up in the fore top.

The mizen topgallant-stay is rove through a bull's-eye in the after part of the main cap, and set up in the main top.

ROYAL RIGGING.

The *breast and after back-stay*, on each side, are seized as the after back-stays on topgallant-masts. The breast back-stay, or *shroud*, is pulled up with a gun-tackle purchase; the after leg has a thimble turned in, and sets up in the after part of the channels, with a lanyard. The *shrouds* are set up in the top (breast back-stay fashion).

Royal-stay.—Splice an eye in the stay to fit the mast-head, cover it, and serve over the splice. It goes on next to the grommet, then the shroud and back-stays, spanned together.

The *fore-royal-stay* is rove through the outer sheave-hole in the flying-jib-boom end, and through a hole in the dolphin-striker, or pulled up through a fair leader on the forecastle.

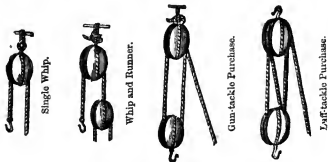
The *main-royal-stay* is rove through a thimble stopped around the fore-topgallant-masthead, through another strapped round the eye of a shroud, and when set up is seized to its own part.

Mizen-royal-stay reeves through a sheave in the after part of the main-topmast trestle-trees, or through a block strapped around the main-topmast-head, through a thimble strapped round the eye of a main-shroud, and seized to its own part.

RATTLING THE LOWER AND TOPMAST RIGGING.

The puttock-shrouds are set up to the hoop around the mast (see p. 13); topmast stayed, rigging and back-stays set up, lanyards secured as lower rigging. Small spars as boat's oars, or anything *light* that will answer, are seized to the shrouds, about four or five feet asunder, for the men to stand upon whilst ratling. The ratlings are fastened round each shroud with a clove-hitch, except at the ends, small eyes are spliced in, and seized to the shroud: in three or four places take a ratling to the after swifter—these are called *shear ratling*.

The ratlings are fastened horizontally to the shrouds, at distances of thirteen to fifteen inches from each other. Every man employed should have a *measure* within his reach, and care should be taken to make the ratlings on one side correspond in a parallel direction with those of the other.



CHAPTER XIII.

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Rigging the Fore and Main-yards.—Trusses to Lower-yards, Iron Jack-stays, Quarter or Topsail-sheet Blocks, Clue Garnet Blocks, Leech-line Blocks, Bunt-line Blocks, Lift Blocks, Foot-ropes and Stirrups, Brace Blocks, Fore Braces, Main Braces.—Rigging the Topsail-yards—Iron Jack-stays, Earing Strap, Foot-ropes and Flemish Horses, Brace Blocks, Fore and Main Top-sail Braces, Mizzen Top-sail Braces, Lift Blocks, Tye Blocks, Quarter Blocks, Topsail Tyes, the Fly Blocks, Reeving Topsail Halliards, the Mizzen Topsail Halliards, Bunt-line Lizards.—Rigging the Topgallant Yards, the Tye or Halliards, Fore Topgallant Braces, Main Topgallant Braces, Mizzen Topgallant Braces, Clue-line and Royal-sheet or Quarter Blocks.—Rigging the Royal Yards—Rigging the Mizzen or Spanker Gaff, Reeving Throat Halliards, Reeving Peak Halliards, Fitting Checks or Brail Blocks, to fit Single Vangs.—Rigging the Spanker Boom, the Topping Lifts, Spanker-boom, Sheet and Guys in one.—A Brig or Schooner's Main-boom.

RIGGING THE FORE AND MAIN YARDS.

TRUSSES TO LOWER YARDS.

MERCHANT vessels in general have iron trusses, figs. 1, 2, and 3, for the ease of bracing the yards, *y*, up. The mechanism may be described as follows:—*h* is the hoop on the mast; *f f*, the hoops on the yard; *a a*, the universal joint; *s*, the screw for setting the hoop tight on the mast; and *c*, for fixing it to the yard.

Fig. 1.

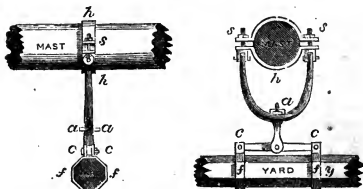


Fig. 2.

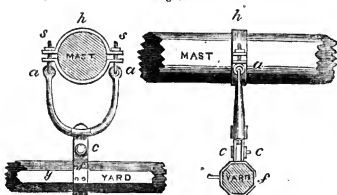
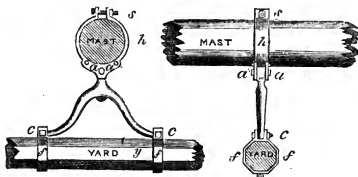


Fig. 3.



Jack-stays.—Iron jack-stays for yards are used in all merchant vessels; they reeve through small eye-bolts, driven into or eyes in hoops round the yard, one on each side of the middle or slings of the yard, and are for the purpose of bending the sails to. The cross jack-yard has no jack-stay.

Quarter or topsail-sheet blocks are iron blocks fitted to the quarter-hoops on each side of the middle or slings of the yard; or fitted each to the iron hoop in the slings of the yard for that purpose; the chain topsail-sheets reeve on their respective sides, and lead down by the mast.

Clue-garnet blocks are iron-bound blocks fitted to the quarter-hoops, when the topsail-sheet blocks are fitted to the sling-hoop.

Leech-line blocks are seized to the iron jack-stay on the forepart of the yard, one-fourth within the cleets on each yard-arm. There are two leech-lines in large ships.

Bunt-line blocks are hooked to eye-bolts underneath the top between the forepart of the trestle-trees.

Lift-blocks are single; an iron plate is bolted across the upper side of the main or fore-cap; it is in the form of a crescent, with the hollow side towards the top-mast. In each end of the crescent, or horn, an eye or hook is turned, and the blocks attached to each. (See sketch, p. 26.) The lifts go over the yard-arms, with an eye spliced in the end to fit them. The other is rove through the block at the cap, and through lubber's-hole on deck, where they are belayed.

Foot-ropes and Stirrups.—The foot-ropes are cut once-and-a-half the length of the yard, excepting lower-yards. An eye, to fit the yard-arm, is spliced in their outer ends, and hang about three feet below the yards. To keep the foot-ropes more parallel to the yards, it is suspended at proper distances, by short pieces of ropes spliced round the foot-rope, called *stirrups*; sometimes two, three, or four on each side of the yard: eyes spliced in the opposite ends, or seized to the jack-stays. The inner ends of the foot-ropes have a small eye, to take a seizing to the jack-stays and round the yard, next the slings.

Brace-blocks are next put over the yard-arms; some go with rope or chain pendants. The block is a large single one, with two scores for rope, and iron-bound for chain, through which the brace reeves.

Fore-braces are clove-hitched, and the end seized aft on the collar of the main-stay, below the splice; the other end taken forward and rove from in (out), through the block on the yard, through a single block strapped into a bolt in the cheek of the main-mast, with a thimble in it, close up to the trestle-trees, then rove from forward aft, through a sheave in the main fife-rail.

The *brace* is often middled, and clove-hitched in the bight on the main-stay, and both ends taken forward and rove as before. (See plate, p. 92.)

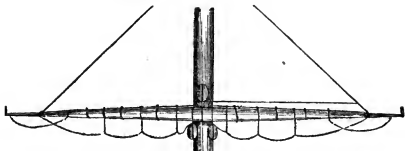
Main-braces.—The standing part of the brace being parcelled, is clenched round a bumkin, or an iron out-rigger on the quarters, for the purpose; the hauling-part reeves through the block at the yard-arm, and back through a block which is strapped to the bumkin end; then through a sheave in the bulwarks (abaft), for the purpose, and belays round a cleat inside.

The blocks are on the fore-side of the main-yard in *brigs*, and the brace reeves through a block strapped into a bolt, with a thimble in it, in the sides of the fore-mast trestle-trees, then rove from aft forward, through a truck seized on to the aftermost fore-mast-shrouds, and belays as before. The braces are rove when the yards go up into their respective places.

The yards being rigged are sent aloft as follows:—The end of the hawser is rove through the block at the lower mast-head, and overhauled down, and made fast to the slings of the yard; then securely stopped along the yard in several places, and also at the upper yard-arm. As it comes on board, the stops

are cut, and easing away on the pendant tackle, then bousing on the other, as the yard advances on board beyond the slings. The yards are placed square, before their respective masts; the hawser is hove upon until the yard is high enough to shackle the chain—slings which are put round the mast-head to hang the yard by: square the yard by braces and lifts, and cast off and unreeve the hawser; then secure the iron trusses on the yard to the mast.

RIGGING THE TOP-SAIL-YARDS.



The iron jack-stays are rove through the eye-bolts or staples, driven into the yard, and forelocked the ends a-midships: the rigging is then placed on the yards as follows:—First, the *easing-strap* with a small thimble seized-in; the *foot-ropes* next, the same as the lower yards, with the addition of *Flemish horses*, which have an eye spliced in each end; one eye is spliced round a thimble, which is on the neck of the *pacific-iron*, or boom-iron, on the yard-arm, and the other is seized round the yard within the arm-cleats.

Brace-blocks are strapped in the same way as the fore or main-yard. The *foretop-sail braces* reeve through the block at the yard-arm, and then taken to the maintop-mast head, where it is rove through a block lashed on each side for the purpose, from thence on deck; the standing-part makes fast to the collar of the main-stay. Brigs the same.

Main-top-sail braces reeve the same as the main braces; the standing-part makes fast to the collar of the mizen-stay. Brigs;—the standing-part makes fast to the after-end of the fore-mast cap. The leading part leads forward through a single block, seized into a single strap, and secured to an eye-bolt on each side of the fore-cap, and through the lubber's-hole on deck.

Mizen top-sail braces reeve through the block at the yard-arm, and cross as the cross-jack braces; but the lead is at the main-mast-head, instead of the shrouds.

Lift-blocks, in large ships, are strapped with an eye to the size of the yard-arm. The lifts reeve through the lower sheave

in the *sister block* in the top-mast shrouds, and through the block in the yard-arm. The standing-part is secured round the top-mast head, and the leading-part leads down the side of the mast, and sets up in the top, or on deck. The lifts are single in the merchant-service.

Tye-blocks are now generally iron-bound, swivel-fashion, and bolted into an eye in the hoop round the yard for the purpose.

Quarter-blocks are double blocks iron-bound, and secured in the same way as tye-blocks; through which the clue-line and topgallant-sheet reeves, and leads down upon deck.

Top-sail tyes.—Large ships have double tyes; the lower end has a single or lower block, called the *Fly-block*, spliced for the halliards. The upper-end is first rove through the bullock-block from aft, then through the tye-block on the yard, and the end taken to the mast-head, so that it can be shortened up.

The *fly-blocks* are large flat blocks; some double, sometimes single, and often one double and one single to each.

Reeving Top-sail Halliards.—When rove double, a single block is strapped into, or hooked, to a swivel-bolt in the after-part of the chains; one end of the halliards is spliced into the upper part of the strap of this block, or bent into a becket put there for the purpose, and the end seized. The other end is then rove through one of the sheaves in the double block in the tye, then through the sheave in the single block in the chains, through the other sheave in the double block, and through a leading block on deck.

The *mizen top-sail halliards* have only one tye. The standing part is clenched or half-hitched to the strap, with the thimble, at the mizen top-mast head, and a single block spliced or secured in the end. Another single block is strapped into a swivel-bolt in the mizen chains, and the halliards rove as with two single blocks; the fall rove through a leading block or cheek.

Bunt-line lizards are spliced round the strap of the top-sail tye-block upon the yard.

The *yard* is next hove up, and the *parral* is passed round the aft part of the mast and seized to the rolling cleats, or jaws fixed on the aft side, the middle, or slings of the yard. The patent iron parrals are now commonly used in merchant ships.

RIGGING THE TOPGALLANT-YARDS.

They are got on board like the topsail-yards. First, leather the rolling-cleats, seize on the parral and quarter-blocks,—footropes the same as topsail-yards—stirrups one to each foot-rope—iron jack-stays secured to the yard with staples, fitted the same way as topsail-yards. Iron sling-hoops as other yards.

The lifts are single; an eye is placed to fit the yard-arm; the other end is rove through the thimble, or bull's-eye in the topgallant-shrouds; a thimble turned into the end, and a lanyard

spliced into it, and set up to another thimble strapped round a puttock-plate inside the dead-eye in the top, or set up on the end.

The tye or halliards reeves through the sheave-hole in the head of the topgallant-mast, and clinches or shackles to the eye in the sling-hoop; the lower end of the halliards comes down abaft the mast, upon which any required purchase is added.

Fore Topgallant-braces.—The standing-part makes fast round the yard-arm, and the leading part reeves through a single tail-block, secured to the first and second shrouds of the main topmast rigging, through lubber's-hole, and through a fair leading sheave on deck.

Main topgallant-braces are single, and go with an eye over the yard-arm. They lead aft to the mizen topmast-rigging, and are fitted to reeve the same as the fore; the hauling part before all, through lubber's-hole, and through a sheave in the rack, or a leading block, to the side abreast of the mizen-mast.

Mizen topgallant-braces are single. An eye is spliced in one end to fit the yard-arm. The other end is rove through a single block, secured to an eye-bolt on each side of the main cap, and through lubber's-hole on deck.

Clue-line and royal sheet, or quarter-blocks, are double, which are strapped with two lashing-eyes, and lash together on the top of the yard—the foremost sheave for topgallant clue-line, after one for royal sheet. The leading part leads down the mast on deck.

The yard is swayed up, and the parrel fixed.



RIGGING THE ROYAL YARDS.

They are fitted the same as topgallant-yards, with little exceptions.

RIGGING THE MIZEN OR SPANKER GAFF.

Some ships in the merchant service have their gaffs fitted to hook to an iron hoop, with a hook or goose-neck in the end of the gaff, instead of jaws (see p. 32). Others travel up and down an iron groove or railway, fitted to the lower mast (using no trysail-mast). Others again use a wooden batten nailed to the mast; some an iron jack-stay, and some a rope one. The trysail-masts are preferable in a *gale of wind*.

Reeving Throat-halliards.—The standing part is spliced into the single-block, which is hooked to the gaff, up through the double block under the top, down through the block, up again through the other sheave in double block, and through a leader, opposite to the peak-halliards.

Reeving Peak-halliards.—The end of the halliard is taken through the lubber's-hole, rove through a double-block at the

mizen-cap, which block hooks to an iron strap over the cap, down through the inside block, *d* (see sketch, p. 32), on the gaff, up again through the double-block before described, then through a block further out, *d*, on the gaff; and the standing part is either hitched round the head of the mizen-topmast, or made fast round the neck of the block, at the after-part of the cap. The standing-part may be spliced round the gaff, by dispensing with one block.

Fitting Cheeks or Brail-blocks.—Gaffs are mostly fitted with cheeks, instead of blocks; and sheaves cut in the jaws for the throat-brails, and fair leaders; which is the approved plan at present, and is very neat.

To fit single Vangs.—Middle the required length of rope, and seize the bights to fit the gaff-end, and lead one end on each side. Vangs steady the gaffs amidships.

All gaffs should be peaked, or elevated to an angle parallel with the mizen-topmast stay.

RIGGING THE SPANKER-BOOM.

The topping lifts have hooks spliced in the end, which hook to eyes in one, and sometimes two, hoops, *d*, *e*, round the boom (see sketch, p. 32); the ends are rove through a single block strapped into a bolt with a thimble in it on each side of the mizen-trestle-trees; and splice a parcelled thimble in the end, for the purpose of hooking the jigger-tackle.

Spanker-boom-sheet and Guys in one.—The boom-sheet is fitted thus;—into a bolt, with a thimble in each quarter, strap a double block with a single strap; then seize into two grommet-straps, worked round the boom (wormed and covered), two single blocks, one on each side, just the outside of the taffrail. Secure these blocks in their straps with a round seizing passed between the block and the boom. The rope for the guys is middle and cut; then an eye, or cut splice made to fit the boom-end. Take the larboard-guy, and reeve it through one of the sheaves in the double block on the quarter, through the single block on the boom, through the other sheave in the double block, through a fair leader in the side, and pull it upon deck. The starboard one is rove in the same manner through the block on the starboard quarter.

A BRIG OR SCHOONER'S MAIN-BOOM.

These booms having so little projection over the stern, guys are unnecessary. On each quarter strap a double block, and one on each side of the boom, in separate straps: through these reeve the sheet, the standing part from the strap of the quarter-block, and hauling part through one of the sheaves of the quarter-block.

CHAPTER XIV.

Rigging a Brig.—Brigantine.—Schooner.—Steamer.—Table showing the comparative strength of Chain Rigging and Hemp Rigging.—Tables of the size of the Standing and Running Rigging of Ships; with the description, size, and number of blocks, hearts, dead-eyes, &c.—Tables of the size of the rigging for schooners.—Tables of the size of the rigging for Cutter-Yachts.—A Table showing the comparative sizes, weight, and strength between Newall and Co's Patent Wire Ropes and Hemp Ropes, for standing Rigging.—A Table showing the comparative strength between Iron Chains and Hemp Ropes.—A Table showing the strength of short round-linked Bobstay, Bowsprit-shroud or Crane Chain, without studs, such as is used for Rigging, &c.—A Table showing the weight of Chain Cable.—Cordage Table, showing the weight of one Fathom of Rope, from 1 to 24 inches inclusive, plain-laid 3 strand, such as used for running rigging, &c.—A Table of the weigh. of Tarred Cordage.—A Table showing the weight of 100 Fathoms of Cable-laid Rope, from 1 to 24 inches. Also a comparative size of Chain.—A Table showing the strength of Plain-laid Rope of three strands.

RIGGING A BRIG.

THE rigging of a brig is so little different from that of the fore and main-masts of a ship, that the description of the one will serve equally well for the other. It may be observed, however, that the braces of the yards on the main-mast lead forward, and are sometimes small chain; the lifts of top-sail and topgallant-yards are fixtures to the mast-heads. In brigs as well as ships a great quantity of mats is used in the way of chafes against the rigging; such as the foremost swiftners of the lower rigging and back-stays, on account of the foot and clew of the courses, when reefed and hauled aft, grinding against them high up. To take the chafe off the foremost shrouds of the topmast rigging, when the topsail yards are braced up, a quarter mat abaft the yards on each side is required. For the back-stays, in the wake of the lower yards, when braced up, mats or plating, or some other substitute, is necessary as a protection. Merchant vessels have these places served and use *scotsmen* (slips of wood so named); but leather neatly stitched on is the best.

RIGGING A BRIGANTINE.

A *Brigantine* is a vessel rigged the same way as a brig on the foremast, and similar to a schooner on the mainmast.

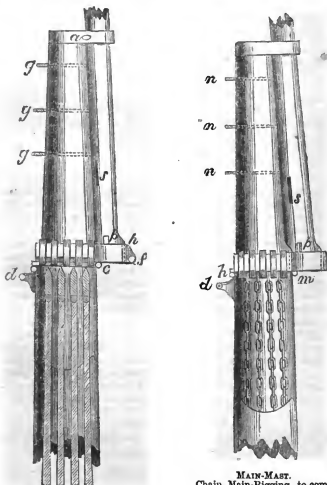
RIGGING A SCHOONER.

A *Schooner* is a vessel with two masts and a bowsprit, whose mainsail and foresail are both suspended by gaffs, like a sloop's.

mainsail; the masts rake aft, but the bowsprit lies nearly horizontal; also a jib-boom and topmasts. The main-stay leads to the head of the foremast; also two jumper-stays, which set up to an eye-bolt in the deck, just at the after-part of the fore-rigging, so that the weather one is always kept taut or tight.

RIGGING A STEAMER.

A Steamer has one to three masts and a bowsprit; the foremast has a topmast and topgallant-mast, on which is set



FORE-MAST.

MAIN-MAST.
Chain Main-Rigging, to come down, to clear the heat from the funnel.

a fore-boom-sail, top-sail, and top-gallant-sail, similar to a schooner's; abaft the main and mizen-masts are a boom-main-sail and mizen. The main and mizen-masts have topmasts, and occasionally carry gaff-top-sails. The bowsprit is short, nearly horizontal, with a jib and flying jibboom in one, upon which the head sails are set.

In the annexed sketches the rigging attached to the iron band round each of the mast-heads is shown thus:—*The rope shrouds* have iron sockets riveted through the ends of them, having eyes formed in the ends of the sockets, for connecting the shrouds to links fitted over the iron-band round the mast-head. They are locked together by a bolt passing through the links and eyes between them, thus completely securing the rigging to the mast-head in a very snug manner.

Steam vessels have a great quantity of chain about the main-mast head on account of the heat from the funnel; such as chain-shrouds about one-third of their length, down from the mast-head, which are similarly secured as the fore-mast shroud, the most part of the main-stay is chain. The peak-halliards, topsail braces, maintop-mast stay, throat-halliards, boom-topping lifts, &c., consists of chain; for which purpose, eye-bolts are fitted in the iron bands round the masts; as, *f* for slinging the fore-yard; *h*, for shackling a block for jib-halliards; *c*, for staysail-halliards; *d*, for throat-halliards; *k*, (on the main-mast) for boom-topping-lift; *m*, for main-stay; *a*, in the iron-cap at the fore-mast head, for hooking a block for the lifts of the fore-yard: *g g g* and *n n n*, for peak-halliards; *s*, a sheave in the heel of the top-mast, and *p*, the fid-hole.

TABLE SHOWING THE COMPARATIVE STRENGTH OF CHAIN-RIGGING, SUCH AS IS GENERALLY USED IN STEAM VESSELS AND HEMP-RIGGING.

Chain Rigging.	Equal to Hemp Rigging.	Weight of Chain per Fathom.	Chain Rigging.	Equal to Hemp Rigging.	Weight of Chain per Fathom.
$\frac{3}{16}$ in.	12 in.	4 lb.	$\frac{3}{16}$ in.	4½ in.	20 lb.
$\frac{1}{4}$ "	2 or 2½ "	6 "	$\frac{1}{8}$ "	5 or 5½ "	25 "
$\frac{1}{8}$ "	2½ " 2½ "	7 "	$\frac{1}{8}$ "	6 " 6½ "	29 "
$\frac{3}{8}$ "	3 " 3½ "	10 "	$\frac{3}{8}$ "	7 " 7½ "	36 "
$\frac{1}{2}$ "	3½ " 4 "	12 "	$\frac{1}{2}$ "	8½ " 9 "	48 "
$\frac{5}{8}$ "	4 " 4½ "	17 "	1 "	10 "	63 "

Recently WIRE ROPES, in lieu of chain, have been used for standing rigging, and they have been found to answer the purpose very well for making shrouds, and for all standing stays, as in such cases they are only applicable; and when once set properly tight, they do not run up when wet, or stretch like hempen ropes. See table showing the comparison between wire and hempen ropes, p. 140.

TABLE SHOWING THE SIZE OF STANDING AND RUNNING RIGGING OF MERCHANT SHIPS.

NAMES OF RIGGING.	Ship of 1100 tons.			Ship of 800 tons.			Ship of 600 tons.			Barque of 450 tons.			Barque of 300 tons.			Brig of 200 tons.		
	Size of Rope in Inches.	Description.	Blocks, &c.	Size in Ins.	Description.	Blocks, &c.	Size in Ins.	Description.	Blocks, &c.	Size in Ins.	Description.	Blocks, &c.	Size in Ins.	Description.	Blocks, &c.	Size in Ins.	Description.	Blocks, &c.
BOWSPRIT GEAR.																		
Gammoning (chain for all classes of vessels)	2																	
Shrouds (chain)	1 1/2	H	10	4	H	9	2	H	8	2	H	7	2	H	6	2	T	2
Laniards for shrouds (four-stranded)	3																	
Bobstays (chain)	2	H	12	8	H	10	8	H	9	2	H	8	2	H	7	2	T	2
Laniards for bobstays	4																	
Main-ropes	4	T		4	T		4	T		4	T		4	T		4	T	4
JIB-BOOM GEAR.																		
Jib-stay and strapping	5 1/2	C	11	1	C	10	1	C	9	1	C	8	1	C	8	1	C	1
Guy, single	5																	
Falls	3	D		4	D		4	D		4	D		4	D		4	D	4
Foot-ropes	7																	
Martingale stay	4 1/2																	
Martingale backropes	4 1/2																	
Martingale falls	2 1/2	D	8	2	D	7	2	D	7	2	D	6	2	D	6	2	T	2
Halliards	3 1/2	S	10	1	S	9	1	S	9	1	S	8	1	S	8	1	S	1
Downhaul	2 1/2	S	8	1	S	8	1	S	7	1	S	7	1	S	7	1	S	1
Sheets	3	S	9	2	S	8	2	S	8	2	S	8	2	S	8	2	S	2
Pendants	4 1/2																	

FORE AND MAIN-TOP-MASTS.		FORE AND MAIN-TOP-SAIL-YARDS.	
Shrouds	6	DE	9
Lanyards for shrouds	2	DE	10
Ratlines	1	DE	10
Standing backstays	34	T	9
Lanyards for backstays	44	{D*}	9
Burton pendants	24	{S*}	9
Falls and strapping	7	T	3
Stays	7	PLDE	9
Lanyards	3	PLDE	9
Pittock shrouds	14	PLDE	9
Lashing	1	PLDE	9
Ratlines	1	PLDE	9
Stay-sail halliards	3	PLDE	9
Downhaul	24	PLDE	9
Strapping	44	PLDE	9
Pendants	44	PLDE	9
Sheets	34	PLDE	9
Tack-lashing	2	PLDE	9
Shrouds	6	DE	17
Lanyards for shrouds	2	DE	18
Ratlines	1	DE	18
Standing backstays	34	T	17
Lanyards for backstays	44	{D*}	17
Burton pendants	24	{S*}	17
Falls and strapping	7	T	2
Stays	7	PLDE	10
Lanyards	3	PLDE	10
Pittock shrouds	14	PLDE	10
Lashing	1	PLDE	10
Ratlines	1	PLDE	10
Stay-sail halliards	3	PLDE	10
Downhaul	24	PLDE	10
Strapping	44	PLDE	10
Pendants	44	PLDE	10
Sheets	34	PLDE	10
Tack-lashing	2	PLDE	10
Shrouds	6	DE	14
Lanyards for shrouds	2	DE	13
Ratlines	1	DE	13
Standing backstays	34	T	13
Lanyards for backstays	44	{D*}	13
Burton pendants	24	{S*}	13
Falls and strapping	7	T	4
Stays	7	PLDE	10
Lanyards	3	PLDE	10
Pittock shrouds	14	PLDE	10
Lashing	1	PLDE	10
Ratlines	1	PLDE	10
Stay-sail halliards	3	PLDE	10
Downhaul	24	PLDE	10
Strapping	44	PLDE	10
Pendants	44	PLDE	10
Sheets	34	PLDE	10
Tack-lashing	2	PLDE	10
Shrouds	6	DE	14
Lanyards for shrouds	2	DE	13
Ratlines	1	DE	13
Standing backstays	34	T	13
Lanyards for backstays	44	{D*}	13
Burton pendants	24	{S*}	13
Falls and strapping	7	T	4
Stays	7	PLDE	10
Lanyards	3	PLDE	10
Pittock shrouds	14	PLDE	10
Lashing	1	PLDE	10
Ratlines	1	PLDE	10
Stay-sail halliards	3	PLDE	10
Downhaul	24	PLDE	10
Strapping	44	PLDE	10
Pendants	44	PLDE	10
Sheets	34	PLDE	10
Tack-lashing	2	PLDE	10
Shrouds	6	DE	14
Lanyards for shrouds	2	DE	13
Ratlines	1	DE	13
Standing backstays	34	T	13
Lanyards for backstays	44	{D*}	13
Burton pendants	24	{S*}	13
Falls and strapping	7	T	4
Stays	7	PLDE	10
Lanyards	3	PLDE	10
Pittock shrouds	14	PLDE	10
Lashing	1	PLDE	10
Ratlines	1	PLDE	10
Stay-sail halliards	3	PLDE	10
Downhaul	24	PLDE	10
Strapping	44	PLDE	10
Pendants	44	PLDE	10
Sheets	34	PLDE	10
Tack-lashing	2	PLDE	10
Shrouds	6	DE	14
Lanyards for shrouds	2	DE	13

FORE AND MAIN-TOP-MASTS	
Shrouds	
Lanyards for shrouds	
Ratlines	
Standing backstays	
Lanyards for backstays	
Burton pendants	
Falls and strapping	
Stays	
Lanyards	
Puttock shrouds	
Lashing	
Ratlines	
Stay-sail halliards	
Downhaul	
Strapping	
Pendants	
Sheets	
Tack-lashing	
FORE AND MAIN-TOP-SAIL-YARDS.	
Top-sail types (all chain)	
Halliards for top-sail types	
Strapping bullock blocks	
Jackstays (iron)	
Foot-ropes	
Stirrups	
Flemish horses	
Bruces	
Lifts	
Farral-rope	
Chse-lines and strapping	

TABLE SHOWING THE SIZE OF STANDING AND RUNNING RIGGING OF MERCHANT SHIPS.

NAMES OF RIGGING.	Ship of 1100 tons.				Ship of 800 tons.				Ship of 600 tons.				Barque of 450 tons.				Barque of 300 tons.				Brig of 200 tons.			
	Size of Rope in Inches.	Description.	Size in Ins.	Number.	Size of Rope in Inches.	Description.	Size in Ins.	Number.	Size of Rope in Inches.	Description.	Size in Ins.	Number.	Size of Rope in Inches.	Description.	Size in Ins.	Number.	Size of Rope in Inches.	Description.	Size in Ins.	Number.	Size of Rope in Inches.	Description.	Size in Ins.	Number.
MIZEN-MAST.																								
Shrouds	6½	D E	9	12	6	D E	8	10	6	D E	8	8	5½	D E	8	8	5	D E	8	8	5	D E	8	8
Laniards for shrouds	3	T	..	2	3	T	..	2	2½	T	..	2	2½	T	..	2	2½	T	..	2	2½	T	..	2
Burton-pendants	4½	{ D* S*	10	2	4	{ D* S*	8	2	4	{ D* S*	7	2	4	{ D* S*	7	2	3½	{ D* S*	7	2	3½	{ D* S*	7	2
Falls and strapping	3	..	10	2	2½	..	8	2	2	..	7	2	2	..	7	2	2	..	7	2	2	..	7	2
Ratlines	1½	T	..	1	1	T	..	1	1	T	..	1	1	T	..	1	1	T	..	1	1	T	..	1
Stay	7½	..	..	..	1½	..	..	..	1	..	..	..	1	..	..	..	1	..	..	..	1	..	..	..
Seizings	1½	..	..	..	1½	..	..	..	1	..	..	..	1	..	..	..	1	..	..	..	1	..	..	..
Laniards	8	..	..	..	2½	..	..	..	2½	..	..	..	2	..	..	..	2	..	..	..	2	..	..	..
CROSS-JACK-YARD.																								
Slings (chain for all vessels)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trusses (iron)	8	..	..	..	3	..	..	..	2½	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Foot-ropes	2½	T	..	2	2½	T	..	2	2½	T	..	2	2½	T	..	2	2½	T	..	2	2½	T	..	2
Stirrups	2½	..	..	..	2½	..	..	..	2½	..	..	..	2½	..	..	..	2½	..	..	..	2½	..	..	..
Lifts	2½	S	..	4	2½	S	..	4	2½	S	..	4	2½	S	..	4	2½	S	..	4	2½	S	..	4
Braces and strapping . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
MIZEN-TOP-MAST.																								
Shrouds	5	D E	8	8	4½	D E	7	8	4	D E	7	6	3½	D E	7	6	3½	D E	7	6	3½	D E	7	6
Laniards for shrouds	2½	..	..	..	2	..	..	..	2	..	..	..	2	..	..	..	2	..	..	..	2	..	..	..

TABLE SHOWING THE SIZE OF THE RIGGING FOR SCHOONERS.

NAMES OF RIGGING.	180 to 200 tons.					170 tons.					160 to 180 tons.				
	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in Inches.	Description of Blocks, &c.	Number.
BOWSPRIT.															
Gunmoning, iron clamp	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shrouds, chain	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bobstays, chain	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
JIB-BOOM.															
Jib-stay	5	..	..	..	..	..	4½	D. I. B.	2	7	..	..	4½	D. I. B.	2
Purchase	2½	Single C.	2	7	..	..	2½	Single C.	2	7	..	..	2½	Single C.	2
Guy	5	..	..	..	..	..	4½	..	2	6	..	..	4½	..	2
Runners	3½	..	2	7	2	2	3½	{ S. I. B.	2	7	2	2	3	{ Fiddle	2
Falls	2½	{ Fiddle	2	7	..	..	2½	{ Fiddle	2	11	..	..	3	{ S. I. B.	2
Martingale-stay, chain	4	..	2	12	..	..	7½	{ Double	2	7	..	..	3½	{ Double	2
Back-ropes	4½	{ S. I. B.	2	7	..	..	4½	{ S. I. B.	2	7	..	..	3½	{ S. I. B.	2
Falls	2½	..	..	..	..	..	2½	..	..	..	..	..	2½	..	..
Foot-ropes	2½	..	..	..	..	..	2½	..	..	..	..	..	2½	..	..
Heel-rope	3½	S. I. B.	1	9	..	..	3	S. I. B.	1	8	..	..	3½	S. I. B.	1
Jib-halliards	2½	Single	2	8	..	..	2½	Single	2	7	..	..	2½	Single	2
Tack, trussler	3½	..	..	..	..	..	3½	..	..	..	..	..	3	..	..
Downhaul	2½	Single	1	9	..	..	2½	Single	1	6	..	..	2½	Single	1
Outhaul	2½	Single	1	9	1	1	2½	Single	1	7	1	1	2½	Single	1
Sheet-pendants	4½	Single	2	8	..	..	4½	..	2	7	..	..	4½	..	2
Sheets	2½	..	..	..	..	..	2½	..	..	..	..	..	2½	..	..
Jib-top-sail halliards*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tack	1½	..	..	..	..	..	1½	..	..	..	..	..	1½	..	..
Sheets	2½	..	..	..	..	..	2½	..	..	..	..	..	2	..	..

FOREMAST.

Shrouds and pendant	64	{ Dead-Eyes Single C.	6	7 1/2	..	5 1/2	{ Dead-Eyes Single C.	6	7	..	..
Ratlines	9-lbr	..	..	3	..	2	..	2	7	..	..
Runners of tackles	4 1/2	..	..	2	..	2 1/2	{ Double S. I. B.	2	7	..	..
Falls	2 1/2	{ Double S. I. B.	2	8	..	2 1/2	{ Double S. I. B.	2	7	..	..
Fore-stay	9	..	..	..	..	3 1/2	..	..	..	..	..
Laniard	2 1/2	..	..	..	..	2	..	..	..	..	..
Storm-stay	4 1/2	..	..	..	..	2 1/2	..	..	..	..	..
Laniard	2	..	..	..	..	2	..	..	..	..	..
Lacing	2 1/2	..	..	..	..	2 1/2	..	..	..	..	..
Halliard	2 1/2	{ Double S. I. B.	2	9	..	2 1/2	{ Double S. I. B.	2	7	..	..
Tack	3 1/2	..	..	..	..	3 1/2	..	..	..	..	..
Fall	2 1/2	{ Double S. I. B.	1	7	..	2	{ Double S. I. B.	1	6	..	..
Downhaul	2 1/2	{ Double S. I. B.	1	7	..	2	{ Double S. I. B.	1	6	..	..
Sheets	2 1/2	{ Double S. I. B.	1	7	..	2	{ Double S. I. B.	1	6	..	..

FORE-YARD.

Square-sail halliards	2 1/2	D. I. B.	2	8	..	2	D. I. B.	2	6	..	..
Braces	2 1/2	S. I. B.	2	6	..	2	S. I. B.	2	5	..	..
Lifts	2 1/2	..	..	..	..	2	..	..	7	..	..
Yard-ropes	3 1/2	{ Double S. I. B.	2	9	..	3	{ Double S. I. B.	2	7	..	..

TOP-SAIL-YARD.

Square top-sail sheets	2 1/2	Double	1	7	..	2 1/2	Double	1	6	..	..
Halliards	3	..	..	..	..	..	..	..	..	..	..

FORE-TOPE-MAST.

Shrouds	3 1/2	..	3	..	..	3	..	..	..	..	..
Stay	3 1/2	..	3	..	..	3	..	..	..	..	..
Tackle	1 1/2	{ Double S. I. B.	1	6	..	1 1/2	{ Double S. I. B.	1	5	..	..

* Square-sail Halliards always used.

TABLE SHOWING THE SIZE OF THE RIGGING FOR SCHOONERS.

NAMES OF RIGGING.	150 to 200 tons.					170 tons.					100 to 150 tons.				
	Size in inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in inches.	Description of Blocks, &c.	Number.
FORE-TOPE-MAST—continued.															
Backstays	31	D. I. B.	4	6	..	2	3	D. I. B.	4	6	..	2	23	D. I. B.	4
Tackle	13	..	..	..	..	..	12	..	..	..	..	..	12	..	..
Mast-rope	24	..	..	..	..	..	24	..	..	..	..	..	24	..	..
GAFF FORE-MAST.															
Throat halliards	34	D. I. B.	2	10	..	..	34	D. I. B.	2	9	..	..	3	D. I. B.	2
Tricing line	2	Single	2	7	2	..	2	Single	2	7	2	..	12	Single	2
Peak halliards	33	S. I. B.	5	10	..	..	33	S. I. B.	5	9	..	..	3	S. I. B.	3
Purchase	2	S. I. B.	1	7	..	..	13	S. I. B.	1	6	..	..	..	..	..
Downhaul	13	Double	1	7	..	..	13	Double	1	6	..	..	..	..	..
Fore-sheets	3	Single	1	6	..	..	13	Single	1	6	..	..	12	Single	1
		D. I. B.	2	9	..	..	23	D. I. B.	2	8	..	..	24	D. I. B.	2
		Double	2	9	..	..	..	Double	2	8	..	..	..	Double	2
FORE-MAST-TOP-MAST.															
Halliards	3	Traveller	1	7	..	..	23	Traveller	1	7	..	..	24	Traveller	1
Sheet	24	Single	1	7	..	..	24	Single	1	6	..	..	2	Single	1
Tackle	13	Double	1	6	..	..	13	Double	1	6	..	..	14	Double	1
Downhaul	14	S. I. B.	1	6	..	..	14	S. I. B.	1	6	..	..	14	S. I. B.	1
		Single	1	5	..	..	..	Single	1	5	..	..	14	Single	1
MAIN-MAST.															
Shrouds	61	Dead-Eyes	4	8	..	..	6	Dead-Eyes	4	7	..	..	51	Dead-Eyes	4
Pendants	5	Single C.	2	8	..	..	43	Single C.	2	8	..	..	44	Single C.	2

[illegible]

TABLE SHOWING THE SIZE OF THE RIGGING FOR SCHOONERS.

NAMES OF RIGGING.	180 to 200 tons.						170 tons.						100 to 130 tons.					
	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Timbles.	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Timbles.	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Timbles.
MAIN-TOPE-MAST.—continued.																		
Jumper-stays	34	Single	4	6	..	..	3	Single	4	6	..	..	22	Single	4	5	..	..
Tackles	12	..	..	..	..	..	12	..	..	..	..	..	12	..	..	..	..	..
Mast-rope	3	..	..	..	..	..	22	..	..	..	..	..	22	..	..	..	..	..
MAIN-GAFF-TOPE-MAST.																		
Halliards	3	Traveller Single	1	7	..	..	22	Traveller Single	1	7	..	..	22	Traveller Single	1	6	..	..
Sheets	24	..	..	..	..	..	24	..	..	..	..	..	24	..	..	..	..	..
Tack	22	Double	1	6	1	1	22	Double	1	6	1	1	22	Double	1	5	1	1
Tackle	12	{ S. I. B. Single	1	6	..	..	12	{ S. I. B. Single	1	6	..	..	12	{ S. I. B. Single	1	5	..	..
Downhaul	12	..	1	5	..	..	12	..	1	5	..	..	12	..	1	5	..	..

TABLE SHOWING THE SIZE OF THE RIGGING FOR CUTTER YACHTS

NAMES OF RIGGING.	30 to 40 tons.					40 to 60 tons.					70 to 90 tons.				
	Size in inches.	Description of blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in inches.	Description of blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in inches.	Description of blocks, &c.	Number.
BOWSPRIT.															
Shrouds, wire	1½	{ L. B. D. L. B. S.	2 2	6 6	2	2	12	D. I. B.	4	7	2	2	1½	D. I. B.	4
Falls	1½	{ L. B. D. L. B. S.	1 1	6 6	1 1	1 1	24	Shackle	..	..	..	..	2½	..	..
Bobstay pendant, wire .	12	{ L. B. D. L. B. S.	1 1	6 6	..	..	2	Shackle	..	..	..	..	2½	Shackle	..
Fall	2	..	..	..	..	..	3	{ D. I. B. S. I. B.	1 1	8 8	1 1	1 1	3½	{ D. I. B. S. I. B.	1 1
Heel-rope	2½	S. I. B.	1	6	1	1	3	S. I. B.	1	8	1	1	2½	S. I. B.	1
Jib-tack	3	Single	1	6	..	..	4	..	..	..	..	..	4½	..	..
Whip	1½	{ S. I. B. C. S. I. B.	1 1	6 6	..	..	2½	{ S. I. B. C. Single	1 1	9 9	..	..	2½	{ S. I. B. C. Single	1 1
Halliards	3	{ S. I. B. C. S. I. B.	1 1	6 6	..	..	4	{ S. I. B. C. Single	2 2	9 9	..	..	4½	{ S. I. B. C. Single	2 2
Purchase	1½	{ S. I. B. Single	1 1	5 5	..	..	12	D. I. B.	2	7	..	..	2	D. I. B.	2
Downhaul	1	..	..	..	..	..	1½	Single	1	5	..	..	1½	Single	1
Inhaul	1½	..	..	..	..	..	1½	Single	1	5	..	..	1½	Single	1
Sheets	3½	..	..	..	..	..	2½	Single C.	2	7	..	..	2½	Single C.	2
Bobstay tricing-line .	1	..	..	..	..	..	1½	Single	1	5	..	..	1½	Single	1
MAST.															
Shrouds, wire	1½	Dead-Eyes	6	5	..	..	2½	Dead-Eyes	8	6½	..	..	2½	Dead-Eyes	8
Landards	2½	..	..	..	..	..	3	..	..	..	..	..	3½	..	..
Most-head pendant, wire	1½	Single C.	2	6	..	..	18	S. I. B. C.	2	8	..	..	17½	S. I. B. C.	2
Runners	3	Single	2	5	2	2	4	Fiddle	2	11	2	2	4½	Fiddle	2
Falls	12	S. I. B.	2	5	2	2	3	Single	2	7	2	2	2½	Single	2
Stay	2½	..	..	..	..	..	3½	Heart	1	8	..	..	4	Heart	1
Landard	2	..	..	..	..	..	2½	..	..	..	..	..	2½	..	..

TABLE SHOWING THE SIZE OF THE RIGGING FOR CUTTER YACHTS.

NAMES OF RIGGING.	30 to 40 tons.						50 to 60 tons.						70 to 90 tons.					
	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Thimbles.	Size in Inches.	Description of Blocks, &c.	Number.	Inches.	Hooks.	Thimbles.
MAST—continued.																		
Fore-balliard	1½	S. I. B.	2	5	..	..	2½	S. I. B.	2	6	..	..	2½	S. I. B.	2	8	..	..
Downhaul	1½	..	..	..	..	..	1½	..	..	..	..	..	2	..	..	..	..	..
Tack	2	..	..	..	..	..	2½	..	..	..	..	..	3	..	..	..	..	..
Fall . . . . .	..	..	..	..	..	..	1½	S. I. B.	2	5	..	..	1½	D. I. B.	2	5	..	..
Sheets	1½	{ S. I. B. Single	2	5	2	4	2	D. I. B.	2	6	2	4	2½	D. I. B.	2	7	2	4
Jack-stay (iron). . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
SQUARE-SAIL-YARD.																		
Square-sail braces	1	..	2	4	..	..	1½	S. I. B.	2	5	..	..	1½	S. I. B.	2	6	..	..
Halliards	1½	S. I. B.	2	..	..	..	2	S. I. B.	2	..	..	..	2½	S. I. B.	2	6	..	..
Sheets and guys	1½	Single	2	5	2	2	2½	Single	2	6	2	2	3	Single	2	8	2	..
Yard-ropes	1½	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
BOOM-MAINS-SAIL.																		
Throat halliards	2½	{ D. I. B. S. I. B.	1	5	..	..	3½	D. I. B.	2	9	..	..	3½	D. I. B.	2	10	..	..
Peak halliards	2½	S. I. B.	5	6	..	..	3½	S. I. B.	5	9	..	..	3½	S. I. B.	5	10	..	..
Purchase . . . . .	..	..	..	..	..	..	1½	..	..	..	..	..	1½	{ D. I. B. S. I. B.	1	7	..	..
Tack-tackle	1	Single	2	4	2	2	1½	{ Double S. I. B.	1	6	1	1	1½	{ Double S. I. B.	1	6	..	..
Trying-line	1	Single	2	5	..	..	1½	Single	2	6	..	..	1½	Single	2	6	..	..
Peak downhaul	1	Single	1	4	..	..	1½	Single	1	5	..	..	1½	Single	1	5	..	..
Reef pendants	1	..	..	..	..	..	3½	..	..	..	..	..	4	..	..	..	..	..
Lacing and earings	1	{ S. I. B. Single	1	5	..	..	1½	{ Fiddle Single	1	7	..	..	1½	{ Fiddle Single	1	10	..	..
Tackle	1	..	1	5	..	..	1½	..	1	6	..	..	2	..	1	6	..	..

Boom-guy pendants	22	..	..	..	1	2	4	..	{ Double Single	1	7	1	..	2
Tackle	14	..	Single	..	2	2	12	..	S. I. B.	..	7	1	..	4
Topping-lifts, wire	14	..	Single	..	2	2	12	..	S. I. B.	..	7	1	..	..
Fall	14	..	S. I. B.	..	..	..	2	..	S. I. B.	..	7	1	..	..
Main-sheet	2	..	{ Double S. I. B. C.	..	..	..	3	..	{ Double D. I. B. S. I. B. C.	..	10	1	..	..
Try-sail-sheets	14	..	{ D. I. B. S. I. B.	..	..	..	24	..	D. I. B.	4	8	1	..	..
Downhaul	1	..	Single	..	..	..	14	..	Single	1	5	1	..	..
Top-Mast.														
Shrouds, wire	1	..	..	..	..	2	14	..	{ D. I. B. S. I. B. C.	..	5	..	..	..
Tackle	1	..	S. I. B.	..	..	..	14	..	S. I. B. C.	..	5	..	..	..
Stay, wire	1	..	S. I. B. C.	..	..	..	12	..	{ Double S. I. B.	..	5	..	..	..
Tackle	..	..	..	..	..	..	3	..	S. I. B.	..	5	..	..	..
Mast-rope	2	..	..	..	..	..	14	..	{ D. I. B. S. I. B.	..	5	..	..	..
Tackle	..	..	..	..	..	..	..	..	S. I. B.	..	5	..	..	..
Gaff-top-sail halliards	2	..	..	..	..	..	8	..	Single	..	6	..	..	..
Top	..	..	..	..	..	..	14	..	..	1	6	..	..	..
Whip	..	..	..	..	..	..	..	..	Single	..	..	..	..	..
Clue-line	14	..	Single	..	..	..	14	..	Single	..	5	..	..	..
Sheet	14	..	..	..	1	..	24	..	Single C.	..	5	..	..	..
Tack	14	..	..	..	..	..	24	..	..	..	5	..	..	..
Tackle	..	..	..	..	..	..	14	..	{ D. I. B. S. I. B.	..	6	..	..	..
Jib-top-sail halliards	12	..	..	..	..	..	..	..	..	1	6	..	..	..
Downhaul	1	..	..	..	..	..	24	..	Single	..	5	..	..	..
Tack	..	..	Single	..	..	..	12	..	Single	..	5	..	..	..
Sheets	1	..	..	..	..	..	12	..	Single	..	5	..	..	..
Signal halliards	14	..	..	..	..	..	4	..	..	..	..	..	..	..
Half-top-sail halliards	1	..	..	..	..	..	24	..	..	..	..	..	..	..
Downhaul	14	..	..	..	..	..	14	..	Single	..	5	..	..	..
Tack	1	..	..	..	2	..	14	..	..	..	..	..	..	..

A TABLE SHOWING THE COMPARATIVE SIZES, WEIGHT, AND STRENGTH BETWEEN NEWALL AND CO.'S PATENT WIRE ROPES AND HEMP ROPES FOR STANDING RIGGING.

Hemp Rope.		Wire Rope of Equivalent Strength.			
Circumference.	lb. Weight per fathom.	Circumference.	lb. Weight per fathom.	Breaking Strain.	Working Load.
2½	2	1	1	2 tons.	6 cwt.
		1½	1½	3 "	9 "
3½	4	1½	2	4 "	12 "
		1¾	2½	5 "	15 "
4½	5	1¾	3	6 "	18 "
		2	3½	7 "	21 "
5½	7	2½	4	8 "	24 "
		2¾	4½	9 "	27 "
6	9	2¾	5	10 "	30 "
		3	5½	11 "	33 "
6½	10	3	6	12 "	36 "
		3½	6½	13 "	39 "
7	12	3½	7	14 "	42 "
		3¾	7½	15 "	45 "
7½	14	3¾	8	16 "	48 "
		4	8½	17 "	51 "
8	16	4	9	18 "	54 "
		4½	9½	19 "	57 "
8½	18	4½	10	20 "	60 "
		4¾	11	22 "	66 "
9½	22	5	12	24 "	72 "
		5½	13	26 "	78 "
10	26	5½	14	28 "	84 "

A TABLE SHOWING THE COMPARATIVE STRENGTH BETWEEN IRON CHAINS AND HEMP ROPES.

Size of the Chains.	Weight in lb. per fathom.	Proof Strain in tons.	Size of Rope.	Weight of Rope in lb. per fathom.
⅝	6	2	2½	1½
⅞	8½	1½	3½	2½
1	11	2½	4	3½
1¼	14	3½	4½	5
1½	18	4½	5½	7
1¾	24	5½	6½	8½
2	28	6½	7	10½
2¼	32	7½	7½	12
2½	36	9½	8½	15
2¾	44	10½	9	17½
3	50	12½	9½	19½
3½	56	14	10	22

NOTE.—One-eighth of an inch of iron in diameter is more than equal to an inch of hemp rope in circumference.

A TABLE SHOWING THE STRENGTH OF SHORT ROUND-LINKED BOBSTAY, BOWSPRIT-SHROUD OR CRANE-CHAIN, WITHOUT STUDS, SUCH AS IS USED FOR RIGGING, ETC.

Size.	Weight of 100 fathoms in lb.	Breaking Strain in tons.		Mean.	Required Test of Strength.
		Maximum.	Minimum.		
1 $\frac{1}{8}$	15,500	75	68	73	31.6
1 $\frac{1}{4}$	.. ..	64	58.2	62.8	27
1 $\frac{3}{8}$	.. ..	50	53.8	57.4	24.7
1 $\frac{1}{2}$	.. ..	54.2	49.6	52.8	22.6
1 $\frac{5}{8}$	.. ..	47.7	45.5	48.4	20.6
1 $\frac{3}{4}$	.. ..	45.3	41.7	44.1	18.8
1 $\frac{7}{8}$	.. ..	41.2	38	40.1	17
1 $\frac{1}{2}$	7481	87.3	34.5	36.3	15.3
1 $\frac{1}{4}$	.. ..	33.6	31.2	32.7	18.6
1	6490	30.1	28.1	29.8	12
1 $\frac{1}{8}$	5600	26.8	25.2	26.1	10.5
1 $\frac{1}{4}$	4500	23.7	22.5	23.1	9.1
1 $\frac{1}{2}$	4000	20.9	20	20.4	7.9
1 $\frac{3}{4}$	3449	17.8	16.6	17.3	6.8
1 $\frac{1}{2}$	2900	14.9	13.5	14.6	5.6
1 $\frac{1}{4}$	2538	12.3	10.8	12	4.6
1 $\frac{1}{8}$	2001	10	8.7	9.7	3.8
1 $\frac{1}{4}$	1583	7.9	6.9	7.7	3
1 $\frac{1}{2}$	1050	6	5.2	5.9	2.3
1 $\frac{3}{4}$	827	4.4	3.8	4.3	1.6
1 $\frac{1}{2}$	581	3	2.7	3	1.1
1 $\frac{1}{4}$	392	1.9	1.7	1.9	.75
1 $\frac{1}{8}$	.. ..	1.1	.97	1	.42

A TABLE SHOWING THE WEIGHT OF CHAIN CABLE.

150 Fathoms of 2 $\frac{1}{8}$ inch	.. ..	Weights	..	45,249 pounds.
150 "	2 $\frac{1}{4}$ "	.. ..	..	87,400 "
150 "	2 "	.. ..	..	87,872 "
150 "	1 $\frac{1}{2}$ "	.. ..	..	84,125 "
150 "	1 $\frac{3}{8}$ "	.. ..	..	82,225 "
150 "	1 $\frac{1}{4}$ "	.. ..	..	27,192 "
150 "	1 $\frac{1}{8}$ "	.. ..	..	25,850 "
150 "	1 $\frac{1}{2}$ "	.. ..	..	28,934 "
150 "	1 $\frac{3}{8}$ "	.. ..	..	17,204 "
150 "	1 $\frac{1}{4}$ "	.. ..	..	14,884 "
150 "	1 $\frac{1}{8}$ "	.. ..	..	11,921 "

CORDBAGE TABLE,* SHOWING THE WEIGHT OF ONE FATHOM OF ROPE, FROM 1 INCH TO 24 INCHES INCLUSIVE, PLAIN LAID THREE-STRAND, SUCH AS USED FOR RUNNING RIGGING, ETC.

Size of Rope in inches.	Weight per fathom.	Size of Rope in inches.	Weight per fathom.	Size of Rope in inches.	Weight per fathom.
	lb. oz.		lb. oz.		lb. oz.
1	0 32	6½	9 0	11½	30 9
1½	0 52	6¾	9 11½	11¾	31 14
1¾	0 82	6½	10 8	12	33 3
1¾	0 11½	7	11 4½	12½	34 9½
2	0 14½	7½	12 2	12¾	36 0
2½	1 2½	7¾	12 0½	12½	37 8
2¾	1 7	7½	13 13½	13	38 15
2¾	1 11½	8	14 12½	13½	40 8½
3	2 1½	8½	15 11½	13¾	42 0
3½	2 7	8½	16 10½	13½	43 9½
3½	2 13½	8½	17 10½	14	45 4½
3¾	3 2½	9	18 10½	15	52 0½
4	3 11	9½	19 11½	16	59 5
4½	4 1½	9½	20 13½	17	66 10
4½	4 10½	9½	21 14½	18	74 10
4¾	5 8½	10	23 1½	19	83 2
5	5 12½	10½	24 3½	20	92 11
5½	6 5½	10½	25 7	21	102 1
5½	7 0	10½	26 11½	22	112 0
5¾	7 9½	11	27 14½	23	122 8
6	8 4½	11½	29 1½	24	134 6

* *Rule to find the Weight of any sized Rope.*—A rope of 1 inch circumference requires 486 fathoms to make one hundred weight. The superficial part of all circles being in proportion to the square of their diameters, consequently the square of their circumference. Therefore a rope of 1 inch in circumference, whose square is one, has 486 fathoms to a cwt.; and, therefore, 486 being divided by the square of the circumference of any rope, the quotient will give the number of fathoms. For instance—

$$9 \times 9 = 81 \quad 486 \text{ (6 the number of fathoms in a cwt.)}$$

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Rule to find the Weight of 120 fathoms of any sized Cable.—Multiply the circumference by the circumference and divide the product by 4, and the quotient will be the number of cwt. in 120 fathoms.

A TABLE OF THE WEIGHT OF TARRED CORDAGE.

Hawsers of 130 fathoms.				Hawsers of 120 fathoms.			
Size.	Weight per 130 fms. each.			Size.	Weight per 120 fms. each.		
Inches.	cwt.	qr.	lb.	Inches.	cwt.	qr.	lb.
6½	13	1	11	9½	22	2	9
6	11	1	13	9	20	1	17
5½	9	2	2	8½	18	0	26
5	7	8	19	8	16	0	6
4½	6	1	22	7½	13	3	16
4	5	0	14	7	12	0	18
3½	3	8	7	6½	10	1	19
3	2	3	20	6	9	0	12
2½	2	0	5	5½	7	3	7
2	1	1	6	5	6	2	1
1½	0	3	13	4½	5	0	23
1	0	1	20	4	4	0	18
¾	0	1	4	3½	3	1	22
..	..	..	..	3	2	2	11
..	..	..	..	2½	1	3	0
..	..	..	..	2	1	1	4

A TABLE SHOWING THE WEIGHT OF 100 FATHOMS OF CABLE-LAID ROPE, FROM 2 TO 24 INCHES.

ALSO A COMPARATIVE SIZE OF CHAIN.

Size.	Threads.	Weight.		Chain Equal.	Size.	Threads.	Weight.		Chain Equal.
		cwt.	qr. lb.				cwt.	qr. lb.	
2	27		3 26	..	13½	954	35	0 7	1½
2½	36	1	1 8	..	14	1026	37	2 24	..
3	54	1	3 25	..	14½	1098	40	1 12	1½
3½	72	2	2 16	..	15	1170	43	0 1	..
4	90	3	1 6	¾	15½	1251	45	3 26	1½
4½	108	3	3 24	..	16	1332	48	3 24	..
5	135	4	8 23	..	16½	1413	51	8 21	..
5½	162	5	3 22	..	17	1503	55	1 9	1½
6	189	6	3 21	..	17½	1593	58	2 6	..
6½	216	7	3 21	..	18	1683	61	3 13	1½
7	252	9	1 1	..	18½	1782	65	2 1	..
7½	288	10	2 9	..	19	1881	69	0 17	1½
8	336	12	0 26	¾	19½	1980	72	3 4	..
8½	378	13	3 15	..	20	2083	76	3 1	..
9	423	15	2 25	..	20½	2187	80	1 16	2
9½	468	17	0 22	¾	21	2295	84	1 14	2
10	522	19	0 21	1	21½	2403	88	1 10	..
10½	576	21	0 19	1	22	2520	92	2 16	..
11	630	23	0 18	..	22½	2646	97	1 3	..
11½	684	25	0 15	1½	23	2768	101	2 8	2½
12	747	27	1 23	1½	23½	2890	105	3 14	..
12½	810	29	8 3	..	24	3006	110	2 1	2½
13	882	32	1 19	..					

A TABLE SHOWING THE STRENGTH OF PLAIN LAID ROPE
OF THREE STRANDS.

Size.	No. of Yarns in a Rope.	Weight of 100 fathoms in lb.	Breaking Strain in tons.		Mean.
			Maximum.	Minimum.	
12	1173	2040	45.5	35.	40.
11½	1077	..	41.7	32.	36.7
11	987	..	38.2	29.3	33.6
10½	900	..	34.9	26.7	30.7
10	816	2136	31.7	24.2	27.9
9½	738	..	28.6	21.8	25.2
9	660	1712	25.7	19.6	22.6
8½	591	..	23.	17.5	20.2
8	522	1379	20.4	15.5	18.
7½	459	..	18.	13.6	15.8
7	399	..	15.8	11.8	13.8
6½	345	..	13.7	10.2	12.
6	294	834	11.75	8.7	10.3
5½	249	712	9.8	7.3	8.7
5	204	..	8.2	6.1	7.2
4½	168	413	6.7	5.	5.9
4	132	..	5.3	4.	4.7
3½	102	..	4.1	3.2	3.7
3	75	203	3.1	2.4	2.8
2½	54	..	2.2	1.8	2.1
2	33	..	1.5	1.3	1.4
1½	27	..	1.28	1.13	1.23
1½	21	..	.90	.86	.88
1¼	15	..	.60	.53	.56
1	12	..	.53	.46	.51
¾	9	..	.51	.42	.46
½	6	..	.28	.28	.28

APPENDIX.

DIMENSIONS OF MASTS AND YARDS OF HER MAJESTY'S SHIPS PHAETON AND VERNON OF 50 GUNS.

NAMES OF THE MASTS AND YARDS.		PHAETON.		VERNON.	
		Ft.	In.	Ft.	In.
Main-mast	{ Housing from the heel to the deck	29	4	..	..
	{ From deck to lower side of trestle-trees.	04	6	..	..
	{ Head	19	0	116	0
	{ Extreme length of mast.	113	10	0	38
Main-top-mast	{ Diameter	0	37	66	1½
	{ Whole length	65	0	0	21
	{ Diameter	0	21½	0	11½
Main-top-gallant-mast	{ Diameter	0	12	29	0
	{ From lower side of fid-hole to hounds.	29	6	..	..
	{ Pole	19	6	96	8
Main-yard	{ Whole length, yard-arms included	06	0	..	..
	{ Yard-arms, each	4	0	0	2½
	{ Diameter	0	23	74	0
Main-top-sail-yard	{ Whole length, yard-arms included	68	0	..	..
	{ Yard-arms, each	5	8	0	15
	{ Diameter	0	15	45	10
Main-top-gallant-yard	{ Whole length, yard-arms included	43	0	1	10
	{ Yard-arms, each	1	10	0	9
	{ Diameter	0	10	..	..
Royal-yard	{ Whole length, yard-arms included	30	6	..	..
	{ Yard-arms, each	1	3	..	..
	{ Diameter	0	6	..	..

Figure 1. The effect of the concentration of the *Agrobacterium* suspension on the transformation efficiency of *Agrobacterium* strains.

DEAN OF THE MEDICAL FACULTY

Description		Quantity	Unit
Fore-mast	Working from heel to deck	1	ft
	From deck to lower side of trussle beam	1	ft
	at heel	1	ft
	Extreme length of mast	1	ft
Fore-top mast	Whole length, heel included	1	ft
	Heel included	1	ft
	Diameter	1	in
	From lower side of beam to top of mast	1	ft
Fore-topgallant mast	Whole length, heel included	1	ft
	Heel included	1	ft
	Diameter	1	in
	From lower side of beam to top of mast	1	ft
Fore-yard	Whole length, yard arms included	1	ft
	Yard arms, each	2	ft
	Diameter	1	in
	Whole length, yard arms included	1	ft
Fore-top-sail-yard	Whole length, yard arms included	1	ft
	Yard arms, each	2	ft
	Diameter	1	in
	Whole length, yard arms included	1	ft
Fore-topgallant yard	Whole length, yard arms included	1	ft
	Yard arms, each	2	ft
	Diameter	1	in
	Whole length, yard arms included	1	ft
Fore-royal-yard	Whole length, yard arms included	1	ft
	Yard arms, each	2	ft
	Diameter	1	in
	Whole length, yard arms included	1	ft
Mizen-mast	Working from heel to deck	1	ft
	From deck to lower side of trussle beam	1	ft
	at heel	1	ft
	Extreme length	1	ft
Mizen-mast	Whole length, heel included	1	ft
	Heel included	1	ft
	Diameter	1	in
	From lower side of beam to top of mast	1	ft

Mizen-top-mast	{ Whole length, head included Head Diameter	46 6 6 3 0 1½	43 10 0 13½ 21 6
Mizen-topgallant-mast	{ From lower side of fid-hole to bounds Pole Diameter	21 6 14 6 0 8½	0 8½ 70 6 0 15
Mizen-cross/jack-yard	{ Whole length, yard-arms included Yard-arms, each Diameter	64 0 2 8 0 15½	0 15 40 1 0 9½
Mizen-topsail-yard	{ Whole length, yard-arms included Yard-arms, each Diameter	47 0 3 11 0 10½	0 9½ 31 0 1 4
Mizen-topgallant-yard	{ Whole length, yard-arms included Yard-arms, each Diameter	23 0 0 11 0 4½	0 10 58 0 0 12½
Mizen-royal-yard	{ Whole length, yard-arms included Yard-arms, each Diameter	45 0 0 10½ 0 15	0 12½ 45 0 6 6
Mizen-gaff	{ Length Diameter	9 7 0 3½	0 3½ 48 0 0 15½
Spanker-boom	{ Length, exclusive of housing Housing Diameter	47 0 16 0 0 15½	0 15½ 50 3 0 8½
Bowsprit	{ Whole length, housing included Housing Diameter	47 0 16 0 0 15½	0 15½ 50 3 0 8½
Jib-boom	{ Length Diameter	47 0 16 0 0 15½	0 15½ 50 3 0 8½
Plying-jib-boom	{ Length Diameter	47 0 16 0 0 15½	0 15½ 50 3 0 8½

These dimensions are also applicable for H.M. first-class frigates of 50 guns, Indefatigable, Leander, and Arethusa.

**DIMENSIONS OF THE PRINCIPAL MASTS AND YARDS BELONGING TO THE SHIPS OF DIFFERENT RATES
IN THE ROYAL NAVY OF GREAT BRITAIN AND IRELAND.**

	Brig of 10 guns.				Brig of 18 guns.				Frigate of 28 guns.				Frigate of 46 guns.			
	Masts.		Yards.		Masts.		Yards.		Masts.		Yards.		Masts.		Yards.	
	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.
Main-mast and yard . . .	Feet. 54.5	Feet. 1.47	Feet. 43.09	Feet. 0.91	Feet. 68.25	Feet. 1.31	Feet. 54.53	Feet. 0.94	Feet. 71.00	Feet. 1.70	Feet. 63.00	Feet. 1.20	Feet. 90.00	Feet. 2.33	Feet. 81.75	Feet. 1.57
Top-mast and yard . . .	31.0	0.83	37.5	0.66	38.09	1.02	41.00	0.70	43.16	1.06	46.50	0.81	54.00	1.34	59.00	1.18
Topgallant-mast and yard .	19.5	0.50	26.0	0.5	25.08	0.59	27.50	0.50	21.58	0.59	28.33	0.50	27.00	0.75	37.50	0.60
Fore-mast and yard . . .	46.5	1.33	43.00	0.91	58.75	1.00	54.50	0.94	64.50	1.58	55.00	1.05	82.50	2.08	71.41	1.36
Top-mast and yard . . .	31.0	0.83	37.5	0.66	36.50	1.02	42.00	0.70	38.16	1.06	41.00	0.70	47.08	1.34	53.33	0.95
Topgallant-mast and yard .	19.5	0.50	26.0	0.50	25.08	0.59	27.50	0.50	19.00	0.56	25.00	0.45	23.41	0.64	32.91	0.56
Mizen-mast . . .	..	..	..	..	..	..	..	..	54.00	1.35	..	..	65.00	1.58	..	..
Crossjack-yard . . .	..	..	..	..	..	..	..	..	..	..	46.50	0.81	..	..	59.00	1.18
Top-mast and yard . . .	..	..	..	..	..	..	..	..	82.41	0.75	31.00	0.48	41.00	0.99	40.66	0.68
Topgallant-mast and yard .	..	..	..	..	..	..	..	..	16.33	0.45	21.33	0.37	20.60	0.57	28.00	0.45
Bowsprit . . .	36.00	1.41	..	..	43.33	1.66	..	..	44.59	1.75	..	..	54.50	2.20	..	..
Spanker-boom . . .	..	..	50.66	0.91	..	..	58.0	1.12	..	..	43.91	0.70	..	..	55.75	0.95
Gaff . . .	..	..	30.33	0.62	..	..	34.0	0.73	..	..	32.50	0.64	..	..	39.00	0.73

**DIMENSIONS OF THE PRINCIPAL MASTS AND YARDS BELONGING TO THE SHIPS OF DIFFERENT RATES
IN THE ROYAL NAVY OF GREAT BRITAIN AND IRELAND.**

	Frigate of 50 guns.				Ship of 74 guns.				Ship of 80 guns.				Ship of 120 guns.			
	Masts.		Yards.		Masts.		Yards.		Masts.		Yards.		Masts.		Yards.	
	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.	Length.	Diameter.
Main-mast and yard	114-0	3-00	96-66	1-89	108-0	3-00	96-66	1-89	118-08	3-31	103-25	2-05	119-66	3-33	104-33	2-05
Top-mast and yard	65-08	1-75	68-00	1-25	64-08	1-60	70-50	1-21	69-00	1-72	74-25	1-38	68-08	1-71	73-66	1-29
Topgallant-mast and yard	33-00	0-91	45-83	0-77	33-00	0-91	45-88	0-77	34-50	0-97	46-06	0-78	34-41	0-97	48-75	0-83
Fore-mast and yard	108-5	2-92	84-33	1-68	98-5	2-60	84-38	1-68	108-00	3-00	89-75	1-79	110-33	3-06	91-08	1-79
Top-mast and yard	58-66	1-75	62-00	1-10	57-66	1-60	61-50	1-06	62-16	1-72	64-60	1-15	68-08	1-71	64-50	1-14
Topgallant-mast and yard	28-08	0-80	40-00	0-70	28-08	0-80	40-00	0-70	30-00	0-83	38-43	0-66	31-00	0-86	42-66	0-71
Mizen-mast	82-05	2-00	..	..	78-09	1-80	..	..	81-66	2-06	..	..	81-00	2-04	..	..
Cross-jack-yard	..	..	70-50	1-21	..	..	70-50	1-21	..	..	74-25	1-33	..	..	74-50	1-29
Top-mast and yard	47-66	1-08	46-08	0-80	47-66	1-08	40-08	0-80	50-33	1-16	49-00	0-84	49-41	1-14	49-00	0-84
Topgallant-mast and yard	22-00	0-66	31-75	0-51	24-00	0-66	31-75	0-51	24-66	0-70	34-00	0-58	24-66	0-71	36-25	0-54
Bowsprit	66-00	2-92	..	..	66-0	2-92	..	..	71-09	2-00	..	..	63-00	3-07	..	..
Spanker-boom	64-25	1-26	68-25	1-06	70-01	1-15	69-68	1-14
Gaff	45-01	0-90	50-91	0-96	62-0	1-00	51-50	1-05

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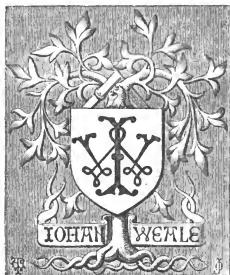
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